Luminescence dating of sediments from ancient irrigation features, and associated with occupation of the hinterland around Anuradhapura, Sri Lanka

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Summary

This study supports a new investigation into the development and decline of irrigation and associated human activity in the Anuradhapura Hinterland, Sri Lanka (section 2). Optically stimulated luminescence (OSL) age determinations have been made for a variety of sediments from bund and tank systems, irrigation channels, palaeosols and ceramic scatter horizons in the Anuradhapura hinterland (section 3). The geomorphological and archaeological significance of the age determinations has been reviewed in the light of the luminescence results and the samples' depositional contexts, to constrain the deposition/formation dates of the sampled sediments integrate the OSL results with independent archaeological and historical expectations. (section 6).

A total of 26 age determinations were made (section 5.3). Dose rate determinations were made using thick source beta counting, high-resolution gamma spectrometry, field gamma spectrometry, measured water contents and calculated cosmic dose rates (sections 4.2.1, 5.1). Equivalent dose determinations were made (sections 4.2.2, 5.2) using the OSL signals from sand sized grains of quartz separated from each sample. Dose rates ranged from 1.1 to 5.0 mGy/a, equivalent dose values ranged from 0.29 to 33 Gy. Age estimates for these samples ranged from 0.14 to 13 ka, the average being 2.9 ka ± 3.1 (section 5.3). Uncertainties on the age estimates were commonly 7% at one standard error.

The OSL age estimates from the largest bund and some ceramic scatter sites were greater than 2000 BC. This is older than expected on archaeological grounds and further investigation of these sites may be warranted. The OSL results from the other samples in the present study date bund construction during the initial urbanisation of Anuradhapura c. 400BC, coincident with the major Nachchaduwa bund construction c. 300AD, and in the Late Iron Age / Early Mediaeval period c. 600AD. They date abandonment of one irrigation channel to the 8th Century AD and its infill up to the late 10th Century when Anuradhapura was finally sacked. A further 8 age estimates, from silts and colluvium, relate to the collapse of infrastructure in the Anuradhapura hinterland during the 10th century and continued landscape response during the 11th century, followed by the lead-in to restoration of the irrigation system during the colonial era.

Preface

This is the second report relating to the Anuradhapura Hinterland project. It includes details from the first report (Burbidge and Sanderson, 2007: 13 samples dated from 6 sites) and OSL age estimates for a further 13 samples from 4 sites sampled in 2007, following review of sampling strategy in the light of results from the 2006 field season.

Contents

1. Introduction

This report is concerned with optically stimulated luminescence (OSL) investigations of sediment samples recovered from ancient irrigation features (bunds, tanks and channels) and ceramic scatter horizons in the Anuradhapura Hinterland, Sri Lanka (80°22' to 80°51' E, 8°08' to 8°24' N). Samples were taken by Professor Ian Simpson in summer 2006 and 2007, to aid assessment of "how and why the hydraulic landscape of the Anuradhapura hinterland was formed, as well as a fuller understanding of 'ceramic scatter' site formation" (Simpson *et al.*, pers comm.).

2. Background

2.1. Context

Anuradhapura is one of Sri Lanka's most important archaeological and religious sites. Early occupation levels are thought to represent some of the oldest Iron Age remains in Sri Lanka (c. 900 BC. Coningham, 2005). These were buried as Anuradhapura expanded into an Iron Age town and later a Mediaeval city: Anuradhapura was the capital of Sri Lanka for c. 1500 years: it was sacked in the mid 9th Century and then finally in 993 AD, after which the capital was moved in 1017 AD (Coningham et al., 2007). Then in the mid to late 13th Century the Sinhalese occupants of the region migrated to the south of Sri Lanka.

The importance of Anuradhapura is inferred by Deraniyagala (WWW) to have been established in the context of major cultural developments around 600 - 500 BC, including the appearance of writing, and various technologies. He notes that this is contemporary with the historic Buddha and coincident with reported voyages of Indian Nobles to Sri Lanka. Buddhism is traditionally supposed to have arrived in Sri Lanka c. 250 BC, following the uniting of the nation under a single high king, but this description may have been subject to political manipulation (Coningham, 1995).

The development of Anuradhapura from, "an Iron Age village to a Mediaeval metropolis" has been examined through phase one of The Anuradhapura (Sri Lanka) Project: Phase 1 - The Citadel. This project indicated a lack of knowledge about the role played by communities in the site's surrounding landscape and led to The Anuradhapura (Sri Lanka) Project: Phase 2 - The Hinterland (project website: http://www.dur.ac.uk/arch.projects/anuradhapura/). This project aims to model pre-urban and urban networks within the plain [around Anuradhapura] in order to assess the impact of urbanisation on communities and their environments in the hinterland.

A programme of geoarchaeological investigations is being conducted in the Anuradhapura hinterland by the School of Biological and Environmental Sciences, University of Stirling (Simpson *et al.*, pers comm.). This is focussing on examination of the origins, usage and abandonment of irrigation features and small-scale settlements outside the monastic complexes, in order to better understand settlement patterns and staple food production in the region. Growth of Anuradhapura in the Iron Age led to major phases of monumental and infrastructure construction, including that of major reservoirs connected by channels (Figure 3.1). However, the region also contains several hundred smaller tank and bund systems for water management on a

more local scale. These appear to have pertained to individual villages (Simpson *et al.*, pers comm.). However it has also been proposed that administrative, economic and political functions were performed through the hinterland's monasteries (project website), in which case communal resources and hence their arrangement might pertain to the monastic sites. Monastery sites are commonly found on (rocky) ridges, between valleys containing irrigation features in alluvium and gleys (Simpson et al., pers comm., Fig.2). Ceramic scatters indicative of smaller scale occupation are found on better-drained red-brown earths on the valley sides. However, while they are located between the monasteries and the fields, association is not considered straightforward since the sherds are non-diagnostic (Simpson *et al.*, pers comm.).

Two major phases of colluvial movement down the valley sides have been inferred from ^{14}C dating of archaeological artefacts in the red-brown earths (c. 28 ka BP and less than 2.8 ka BP, Deraniyagala, 1992, in Simpson *et al.*, pers comm.). This part of the landscape is presently woodland and chena. It has been proposed that agricultural irrigation systems were introduced in the Anuradhapura area during the Early Iron Age (after c. 1000 BC), and that they were well established by the 3rd Century BC (Deraniyagala, WWW). Tank and bund features are thought to have originated by at least the 1st Century BC (Simpson *et al.*, pers comm.). The irrigation system is thought to have been largely or totally abandoned in the 1100s AD, following the demise of Anuradhapura, until being partially restored from the 1800s.

The research programme of Simpson *et al.* (pers comm.) selected seven sites for detailed geoarchaeological examination, and sampling for laboratory analyses including soil micromorphology, geochemistry, and luminescence dating. These included tank and bund systems, infilled irrigation channels (including one moat) and sites with ceramic scatter horizons thought to represent occupation. Sediments encountered at these sites included palaeo-landsurfaces (possibly colluvially or anthropogenically accumulated), materials reworked for the construction of bunds and a platform, water-lain and colluvial/anthropogenic infills, and anthropogenic occupation deposits.

2.2. Aims

The principal aim of the present study is to support a new investigation into the development and decline of irrigation and associated human activity in the Anuradhapura Hinterland, Sri Lanka. Specifically the present study aims 1/ to investigate the potential of sediments from a variety of landscape contexts in the Anuradhapura hinterland to yield geomorphologically and hence archaeologically meaningful OSL age estimates, and thus 2/ to help constrain the dates of construction, usage and abandonment of these contexts, in the light of independent geochemical and micromorphological information.

2.3. Luminescence dating of sediments

Optically stimulated luminescence originates as a consequence of energy deposited within sedimentary minerals in response to naturally occurring ionising radiation in the sample and its environment. By stimulating the minerals in the laboratory using lasers or other suitable light sources, part of this stored energy is released, resulting in

luminescence that can be measured to quantify the radiation history of the sample. Luminescence signals can be erased either by heat or exposure to daylight, and for sedimentary materials exposure to light during erosional or transport phases acts as the zeroing mechanism. Enclosure of the sediment after final deposition protects it from light and allows the accumulation of luminescence signals that can be used for age estimation. The luminescence age is determined by combining luminescence determinations of the radiation dose equivalent to the signals recovered from the samples (the equivalent dose), with measurements of the radiation dosimetry of the sample and its environment (the dose rate). The natural dose rate comprises alpha, beta and gamma radiation produced by the decay of naturally occurring radionuclides (^{40}K, and the U and Th decay series), and cosmic radiation. The luminescence age is the quotient of equivalent dose over dose rate.

With sediment dating it is important to recognise that the luminescence age might represent an accumulated signal originating from many cycles of erosion, transport, bleaching and deposition. Only in the situation where undisturbed sediments are available and associated with effective zeroing at time of deposition can sediment dates be interpreted in terms of simple events. Photostimulation, or optical stimulation, targets readily reset luminescence signals, and regenerative procedures for determining the stored dose within single aliquots or mineral grains (Murray and Wintle, 2000) provided a means of assessing the homogeneity of doses within sediments. This approach can provide important information for diagnosing mixed sedimentary systems, and hence assists the interpretation of luminescence age determinations (e.g. Olley *et al.*, 1998; 1999). It is also important to recognise that the dose rate values for age estimation are based on contemporary measurements of the sample and its environment. The appropriateness of these determinations is assessed with respect to spatial and temporal variations from the average dose rate to the sample in-situ during its burial. Expected deviations are modelled and used to adjust the measured values, e.g. dose rates in clast rich sediments or thin sedimentary layers may be better represented by certain measurement methods: water absorbs radiation, so average water content during burial is estimated using the sample's water retention properties and by modelling it's hydrological history: gross precipitation or leaching of radionuclides can be detected using gamma spectrometry: U series mobilisation and disequilibrium may also require modelling.

It is probable that for the sediments in the present study, the coarse hard mineral fraction, used for luminescence measurements, contains mineral grains weathered from bedrock and reworked into the valley soils largely by colluvial action, but also through fluvial action and sub-aerial reworking. Mineral grains subject to repeated cycles of fluvial and/or sub-aerial reworking are likely to have small residual OSL signals at deposition, but limited numbers of cycles and/or short transport distances may leave larger and less homogeneous residuals. Colluvial transport will mix grains from all parts of the parent sediment, but limited potential for light exposure may leave significant residual signals in at least some grains. Palaeosols now buried beneath bund structures may have accumulated through any of the above mechanisms, and would subsequently have been subject to post depositional mixing by bioturbation: if this was sufficiently vigorous it might leave a small OSL residual, such that the OSL age would approximate the burial of the soil. Sediments forming bund structures are likely to have been rapidly reworked by people from any of the

above contexts, such that few grains in the sediment would have been exposed to light, and the OSL age of the original context is likely to be retained.

OSL dating of Sri Lankan sediments to date has compared relatively well although not perfectly with independent methods (Abeyratne *et al.*, 1997), however this study applied different methodology to older samples from a different depositional context than the present study. Detailed OSL investigations of canal deposits in a similar landscape setting to the present study have indicated that fill materials may be successfully dated by OSL and provide important information to aid the interpretation of determinations by other methods (Sanderson *et al.*, 2003; Bishop *et al.*, 2004). Shaw *et al*., (2007) report preliminary luminescence investigations of samples from an Indian irrigation system similar to that examined in the present study, and also associated with early Buddhism. The authors considered their results to be preliminary largely because of a lack of in-situ gamma dose rate measurements associated with the samples. They indicated that they considered sealed contexts (buried land surfaces and contents of pot artefacts) to have given more reliable age indications than e.g. "reservoir deposits" or stone packing. "Reservoir deposits" yielded similar or lower preliminary ages than associated "predam deposits", but estimates ranged from 790 AD to 13610 BC. Preliminary age estimates from contexts they considered more reliable ranged from c. 210 AD to c. 3680 BC.

The present report outlines the samples collected for the present study, the measurements undertaken, and the conclusions that can be drawn from the OSL results.

3. Sampling

Sampling was undertaken in the Anuradhapura Hinterland (Figure 3.1) in May 2006 and August 2007 by Professor Ian Simpson. Samples for luminescence analysis were taken by driving copper tubes into the cleaned face of excavated sections, then sealing the tubes with foil and tape upon their extraction. The sampling holes were enlarged for field gamma spectrometry measurements, and bulk sediment samples were collected from around the location of each tube sample. Luminescence sampling forms are attached in Appendix A. Thirty one samples were taken from ten sites: four tank and bund systems (C009: Figure 3.2, E400: Figure 3.4, Z021: Figure 3.6, Z021a: Figure 3.10), two large irrigation channels and one moat (filled: C018: Figure 3.3, F517:Figure 3.7, C112: Figure 3.9), two sites with ceramic scatter horizons (F101, F102: Figure 3.5), and one with ceramic bearing horizons above an anthropogenic gravel platform (D339: Figure 3.8).

The sediments sampled for luminescence dating were clay loams, sandy clays, silty clay loams, sandy clay loams, sandy silt loams and sandy loams, some with a significant component of grit (angular/subangular gravel). Samples from the tank and bund systems included horizons interpreted as the palaeo-landsurface (sealed by the bund structure), the bund structure and sedimentary units within it, and alluvial fill horizons in the tanks. Samples from the channels included horizons interpreted as different phases of channel fill, some alluvial, some colluvial or anthropogenic. Samples from the ceramic scatter sites included horizons interpreted as the palaeo-landsurface, as an anthropogenically emplaced gravel platform, and ceramic scatter

horizons thought to have accumulated both in situ and through colluvial or anthropogenic redeposition. All the sediments at the Z021 site contained manganese nodules, which were interpreted as precipitates consequent from particularly poor drainage (Simpson *et al.*, pers comm.). Calcite precipitates were observed in the upper horizon of the Z021 bund, and the upper part of the C018 channel infill. Mottling and colour variations in the lower sediments of the C112 moat infill also indicated poor drainage and seasonal saturation.

Sampling details, including the names assigned to each tube and bulk sample in the field, and the laboratory (SUTL) numbers assigned to each upon arrival at the SUERC luminescence dating laboratories, are summarised in Table 3.1.

Figure 3.1. Maps showing location of Anuradhapura, and nad many of the sampling locations (from Simpson *et al*., pers comm. and Coningham et al., 2007): a. location and major irrigation features, b. identified monastic sites, c. identified ceramic scatter sites (apparent site alignments follow lines surveyed).

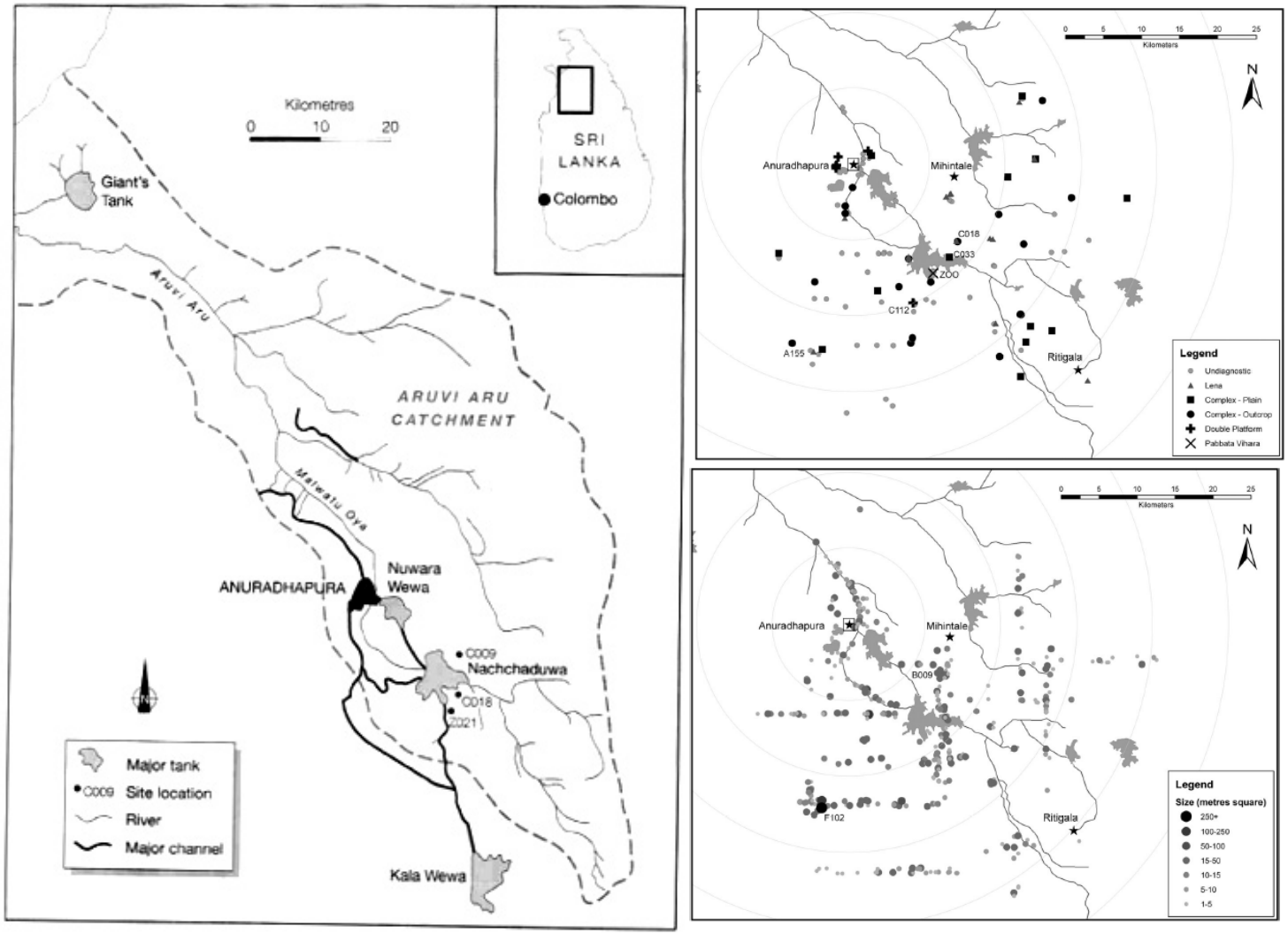


Figure 3.2. C009 Section diagram with context descriptions and sampling locations (from Simpson *et al.*, pers comm.).

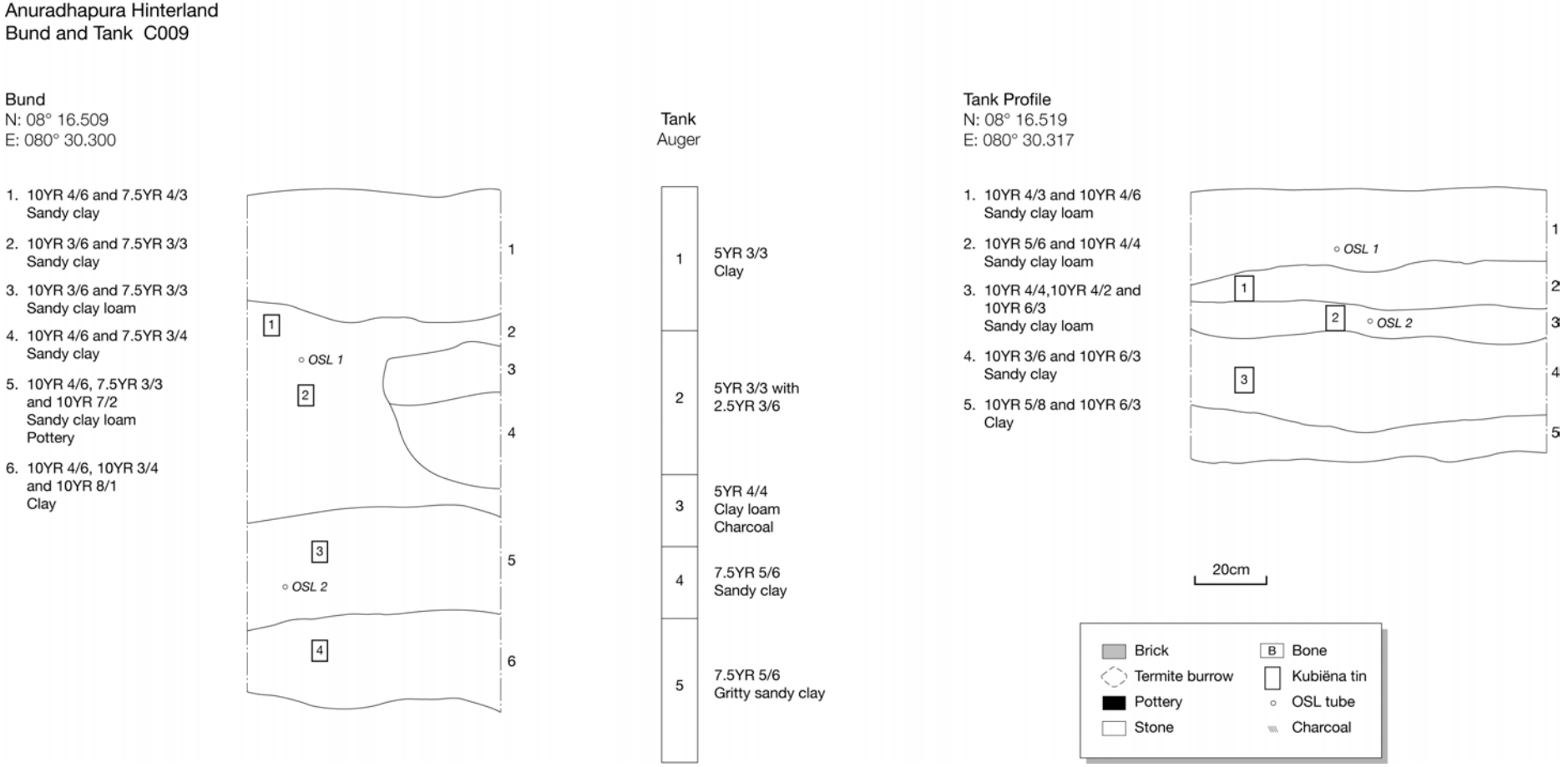


Figure 3.3. C018 Section diagram with context descriptions and sampling locations (from Simpson *et al.*, pers comm.).

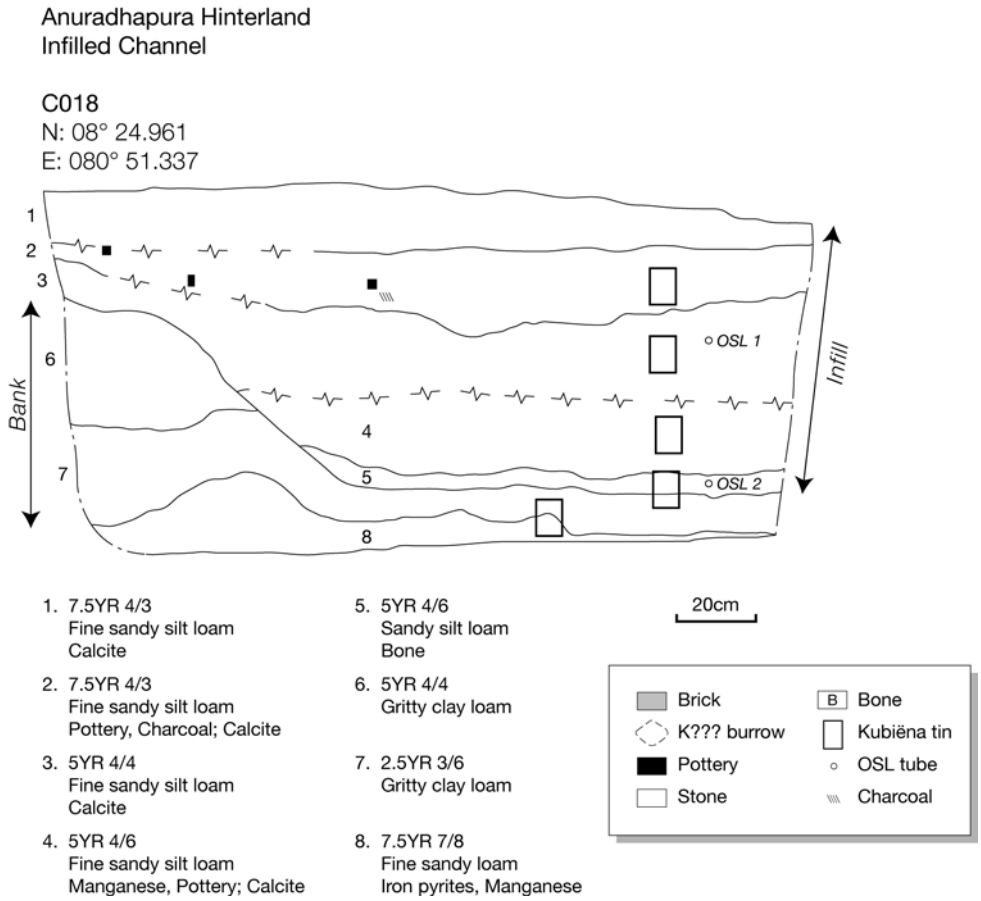


Figure 3.4. E400 Section diagram with context descriptions and sampling locations (from Simpson *et al.*, pers comm.).

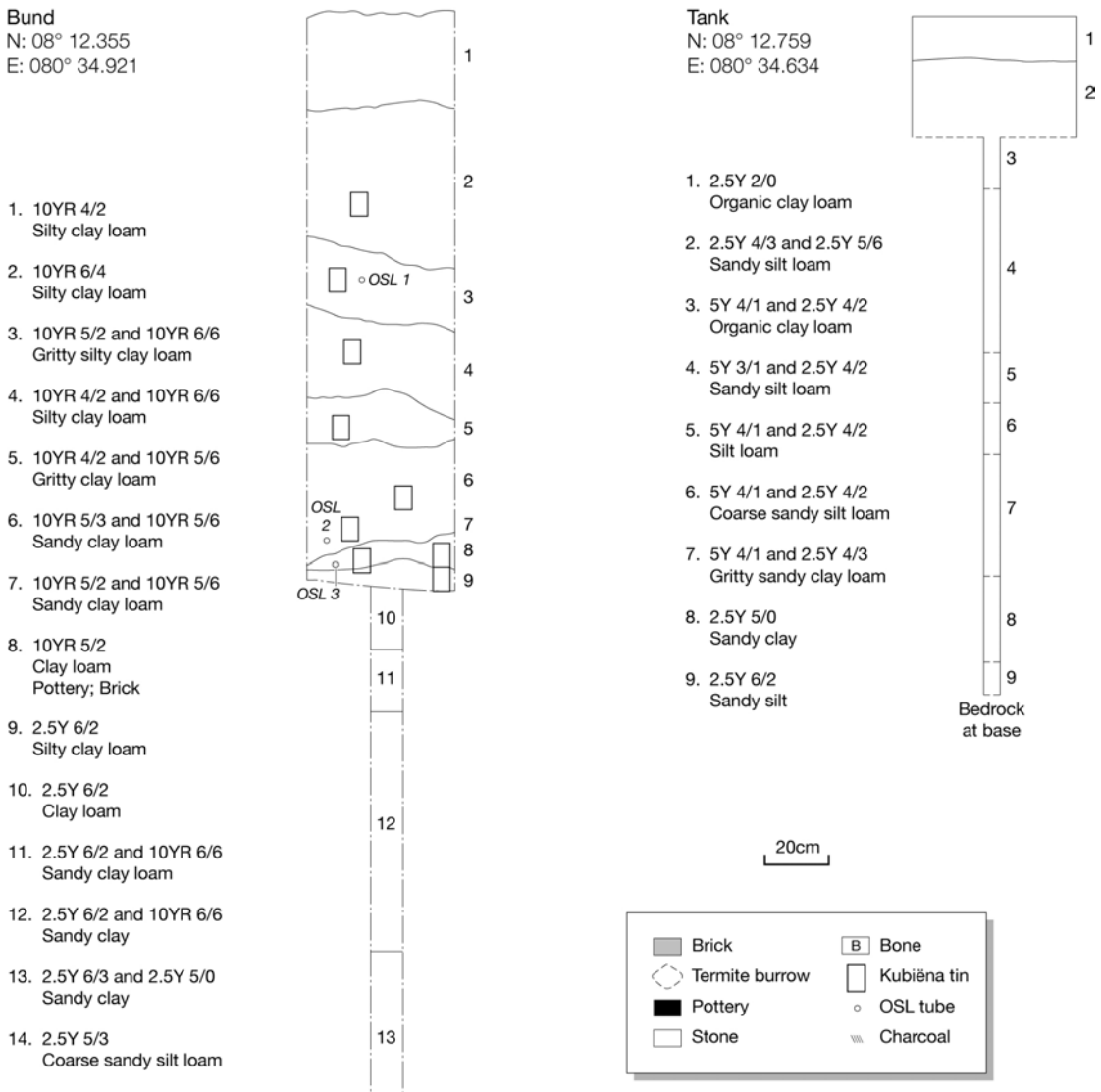


Figure 3.5. B009, F101 and F102 Section diagrams with context descriptions and sampling locations (No OSL samples from B009) (from Simpson *et al*., pers comm.).

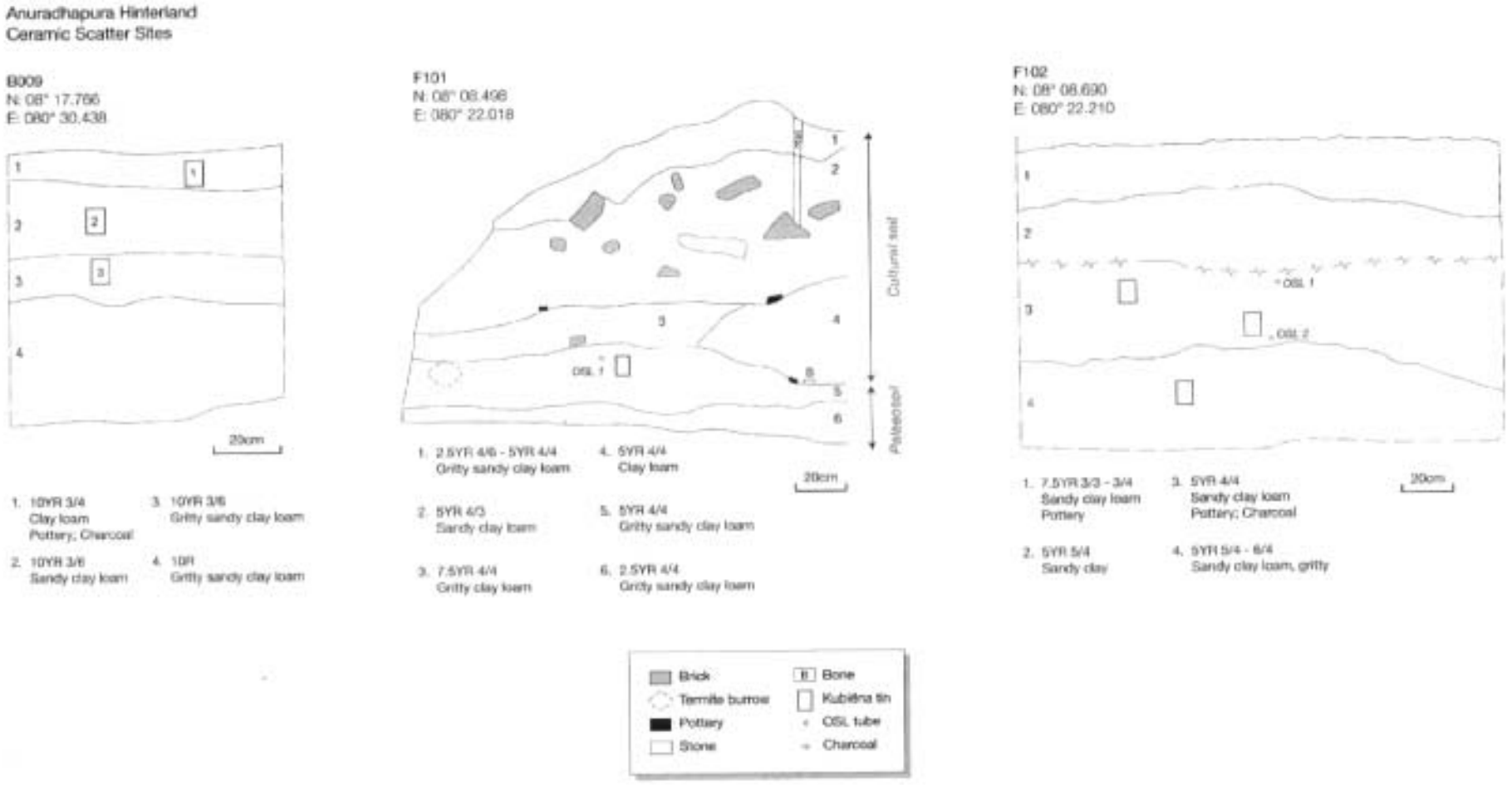


Figure 3.6. Z021 Section diagrams with context descriptions and sampling locations (from Simpson *et al.*, pers comm.).
Anuradhapura Hinterland
Bund and Tank Z021

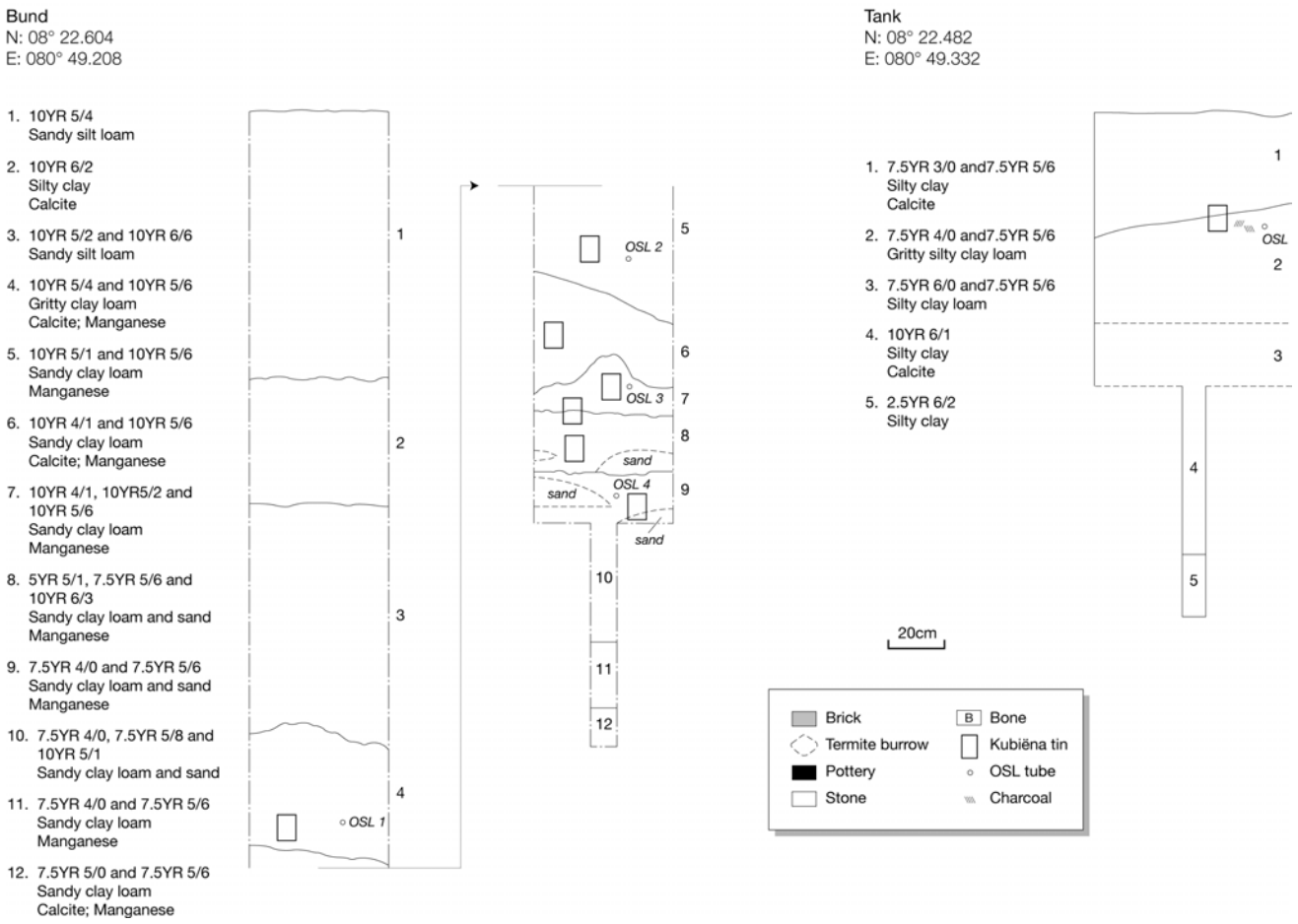
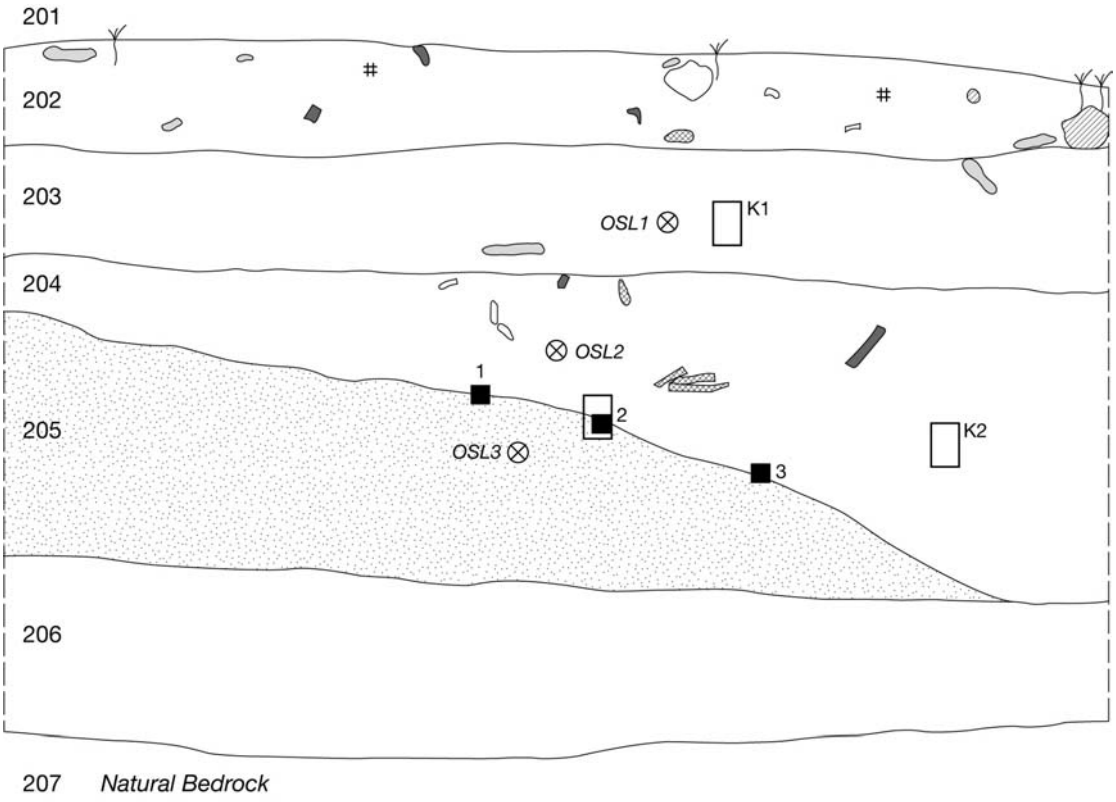


Figure 3.7. F517 Section diagram with context descriptions and sampling locations (Simpson, pers comm.).

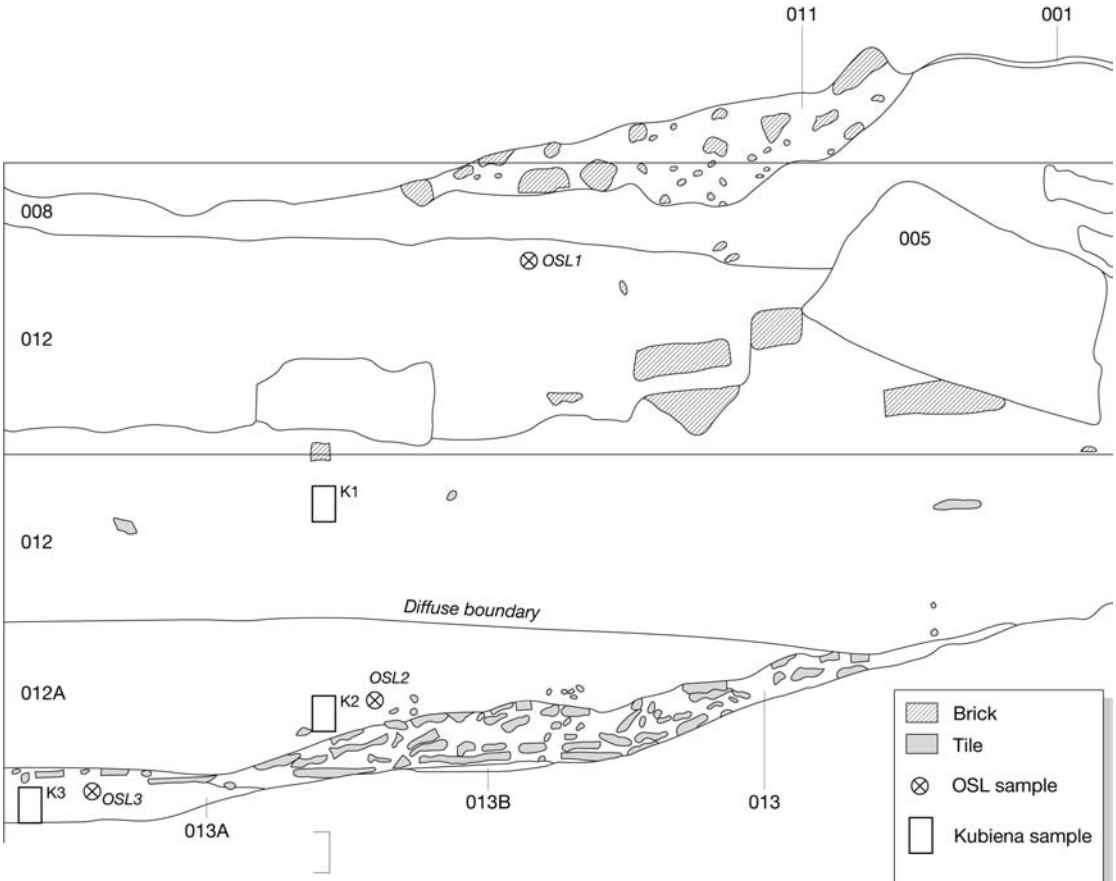
Context No.	*Munsell Colour*	*Texture*	*Field interpretation*
103	10YR 5/4	Sandy silt loam	Top soil. Charcoal
106	7.5YR 5/4	Brick inclusions	Foundations
107	7.5YR 5/6	Sandy silt loam	Colluvium/anthropogenic: mixed 106/108
108	7.5YR 5/4	Sandy silt loam	Colluvium/anthropogenic
109	7.5YR 5/4	Sandy silt loam	Colluvium/anthropogenic
110	7.5YR 5/6	Gravel	Natural
111	10YR 5/8	Gritty loamy sand	Infill of channel?
113	7.5YR 5/6	Fine sandy silt loam	Alluvial/anthropogenic inc. pottery
114	7.5YR 5/8	Rock	Bedrock

Figure 3.8. D339 Section diagram with context descriptions and sampling locations (Simpson, pers comm.).



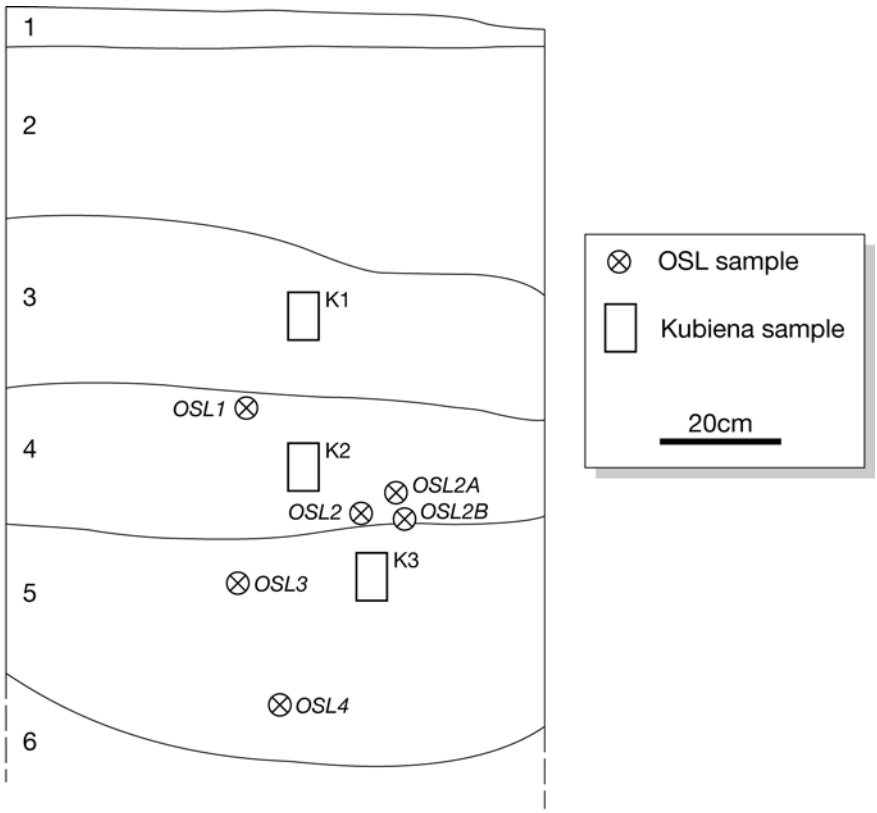
Context No.	*Munsell Colour*	*Texture*	*Field interpretation*
201	Surface clean		
202	7.5YR 4/4	Gritty sandy loam	Cultural/colluvium
203	7.5YR 5/4	Gritty sandy loam	Cultural/colluvium
204	7.5YR 5/6	Gritty sandy loam	Cultural/colluvium Terracotta inclusions
205	5YR 5/6	Gritty sandy loam	Packing material
206	5YR 5/8	Gritty sandy loam	Underlying colluvium (red earth)

Figure 3.9. C112 Section diagram with context descriptions and sampling locations (Simpson, pers comm.).



Context No.	*Munsell Colour*	*Texture*	*Field interpretation*
011	7.5YR 4/2	Sandy loam	Brick collapse
008	7.5YR 5/2	Sandy (clay) loam	Sediment accumulation post abandonment
012	10YR 5/8	Sandy (clay) loam	Sediment accumulation post abandonment
012A	10YR 6/6 7.5YR 5/6 } Mottled	Loamy sand	Sediment accumulation post abandonment (seasonally wet) poorly drained
013	10YR 4/2	Coarse sandy clay loam	Tile collapse
013A	10YR 7/6 7.5YR 6/8 } Mottled	Sandy clay	Sediment accumulation in moat prior to abandonment
013B	10YR 6/6	Loamy sand	As 013A (drier)

Figure 3.10. Z021a Section diagram with context descriptions and sampling locations (Simpson, pers comm.).



Context No.	*Munsell Colour*	*Texture*	*Field interpretation*
1	10YR 4/3	Sandy loam	
2	10YR 5/6	Sandy (clay) loam	Topsoil bund
3	mottled 10YR 4/1 + 7.5YR 4/3	Gritty, sandy clay loam	Bund; pottery
4	10YR 4/4	Gritty, sandy clay loam	Bund; pottery
5	mottled 10YR 5/4 + 10YR 7/8	Sandy loam	Buried land surface
6	10YR 6/8	Loamy sand	Very compact to bedrock

Table 3.1. Sample locations, descriptions, and SUERC laboratory numbers

Sample Number		Type	Dry	Coordinates		Depth	Context		Information
SUERC	Field		Sed.(g)	N	E	(cm)[a.]	No.	Description	
SUTL 2090	C009 B1	Tube	103	08° 16.509	080° 30.300	*48*	2	Sandy clay, used to build upper bund	Date sediment used to construct upper bund.
SUTL 2091	C009 B2	Tube	88	08° 16.509	080° 30.300	*110*	3	Sandy clay loam, used to build lower bund	Date bund construction (phase) if bleached, if not dates sediment source
SUTL 2092	C009 T1	Tube	116	08° 16.519	080° 30.317	*17*	2	Sandy clay loam, accumulated in tank	Constrain timing and rate of infill, TPQ abandonment?
SUTL 2093	C009 T2	Tube	109	08° 16.519	080° 30.317	*36*	3	Sandy clay loam, accumulated in tank	TAQ bund construction / tank cleaning
SUTL 2094	C018 1	Tube	138	08° 24.961	080° 51.337	*32*	3	Fine sandy silt loam + calcite, main channel infill	Constrain main channel infill episode
SUTL 2095	C018 2	Tube	66	08° 24.961	080° 51.337	*69*	5	Thin sandy silt loam + bone, lowest infill	TAQ commencement of channel infill
SUTL 2096	E400 1	Tube	39	08° 12.355	080° 34.921	*84*	3	Gritty silty clay loam, used to build upper bund	Date sediment used to construct upper bund, possibly TAQ bund construction
SUTL 2097	E400 2	Tube	55	08° 12.355	080° 34.921	*164*	7	Sandy clay loam, used to build lower bund	Dates construction (phase) if bleached during, if not dates sediment source
SUTL 2098	E400 3	Tube	51	08° 12.355	080° 34.921	*173*	8	Clay loam + pot & brick, fossil soil below bund	Age of pre-construction land surface: TPQ bund construction
SUTL 2099	F101	Tube	65	08° 08.498	080° 22.018	*80*	5	Gritty sandy clay loam, fossil soil below cultural	Age of fossil soil, TPQ accumulation of cultural overburden
SUTL 2100	F102 1	Tube	82	08° 08.690	080° 22.210	*56*	3	Sandy clay loam, ceramic scatter horizon, upper	TPQ cessation of ceramic scatter accumulation
SUTL 2101	F102 2	Tube	46	08° 08.690	080° 22.210	*80*	3	Sandy clay loam, ceramic scatter horizon, lower	TAQ commencement of ceramic scatter accumulation
SUTL 2102	Z021 1	Tube	87	08° 22.604	080° 49.208	*256*	4	Gritty clay loam + calcite & manganese, bund	Date sediment used to construct upper bund, possibly TAQ bund construction
SUTL 2103	Z021 2	Tube	76	08° 22.604	080° 49.208	*298*	5	Sandy clay loam + manganese, used to build bur	Date bund construction (phase) if bleached, if not dates sediment source
SUTL 2104	Z021 3	Tube	93	08° 22.604	080° 49.208	*345*	7	Sandy clay loam + manganese, lower bund	Date bund construction (phase) if bleached, if not dates sediment source
SUTL 2105	Z021 4	Tube	75	08° 22.604	080° 49.208	*384*	9	Sandy clay loam + sand, lower bund / fossil soil	Age of pre-construction land surface: TPQ bund construction
SUTL 2106	Z021 T	Tube	17	08° 22.428	080° 49.332	*39*	2	Gritty silty clay loam, accumulated in tank	TAQ bund construction / tank cleaning, TPQ abandonment?
SUTL 2214	F517 1	Tube	81			*75*	108	Sandy silt loam + disintegrated brick	Constrain accumulation of (anthropogenic) colluvium and construction above
SUTL 2215	F517 2	Tube	71			*151*	113	Fine sandy silt loam + pottery, alluvial fill	Date silting of channel and constrain colluvial/anthropogenic sediments above
SUTL 2216	D339 1	Tube	81			*31*	203	Gritty sandy loam, cultural/colluvium	Constrain phases or timescale of site usage
SUTL 2217	D339 2	Tube	102			*54*	204	Gritty sandy loam, cultural/colluvium (terracotta)	Constrain initiation of site and early phase of site usage
SUTL 2218	D339 3	Tube	82			*73*	205	Gritty sandy loam: gravelly packing material	Date emplacement (anthropogenic) of platform: constrain initiation of site
SUTL 2219	C112 1	Tube	66			*25*	12	Sandy (clay) loam + brick rubble	Post abandonment sedimentation, and main phases of building collapse
SUTL 2220	C112 2	Tube	88			*115*	012a	Loamy sand, mottled	Constrain abandonment and main phases of building collapse
SUTL 2221	C112 3	Tube	89			*138*	013a	Sandy clay, mottled. + broken roof tiles.	Lowermost fill of moat: constrain construction and abandonment
SUTL 2222	Z021a 1	Tube	71			*65*	4	Gritty, sandy clay loam, bund (pottery)	Date bund construction if bleached, if not dates sediment source
SUTL 2223	Z021a 2	Tube	50			*79*	4	Gritty, sandy clay loam, bund (pottery)	Date bund construction if bleached, if not dates sediment source
SUTL 2224	Z021a 2a	Tube	59			*82*	4	Gritty, sandy clay loam, bund (pottery)	Date bund construction if bleached, if not dates sediment source
SUTL 2225	Z021a 2b	Tube	71			*84*	4/5	Boundary bund-buried land surface	Mixture of 4 and 5
SUTL 2226	Z021a 3	Tube	77			*95*	5	Sandy clay loam, mottled, buried land surface	Age of pre-construction land surface: TPQ bund construction
SUTL 2227	Z021a 4	Tube	86			*119*	5	Sandy clay loam, mottled, buried land surface	Age of pre-construction land surface/substrate: TPQ bund construction

a. values in italics estimated from section diagrams b. TAQ: terminus ante-quem, TPQ: terminus post-quem

4. Methods

4.1. Sample preparation

All sample handling and preparation was conducted under safelight conditions in the SUERC luminescence dating laboratories.

Each sample was first subject to water content determination in the sampling tube. The tubes were unpacked and weighed with gauze taped over one end ("field"). They were then soaked in deionised water for two hours and reweighed ("saturated"), then allowed to drain at room temperature overnight and reweighed ("drained upper limit"), and finally dried at 50°C and reweighed ("dry"). Sample material was then extracted from the tubes: potentially light exposed material from the ends was first removed, then the "core" was excavated for further measurements.

In the case of the samples taken in 2006: Up to ~100 g of the core material was weighed into HDPE pots for high-resolution gamma spectrometry (HRGS) measurement. The pots were sealed with epoxy resin and left for at least 4 weeks prior to measurement to allow equilibriation of ^{222}Rn daughters. After HRGS measurement the pots were opened and 20 g sub-sampled for thick source beta counting (TSBC) measurement. Following this the core sample material was recombined, and sub-sampled for further processing to obtain a sand-sized quartz separate for equivalent dose determination.

In the case of the samples taken in 2007: 100 g of dried bulk sediment from around the location of the tube sample was weighed into HDPE pots for high-resolution gamma spectrometry (HRGS) measurement. A single bulk sediment sample was submitted for samples SUTL 2223, 2224 and 2225, which were taken in close proximity to each other. The pots were sealed with epoxy resin and left for at least 2 weeks prior to measurement to allow equilibriation of ^{222}Rn daughters. Thick source beta counting (TSBC) measurements were each conducted on 20 g of the material excavated from the ends of the luminescence sample tubes.

Approximately 50 g of material from the core of each sample tube was processed for luminescence measurements, where available. With the object of separating sand-sized quartz grains from the bulk sediment, luminescence sub-samples were wet sieved to obtain 90-150 μm grains, which were treated with 1 M HCl for 10 minutes to dissolve carbonates: no strong reactions were observed. The treated material was centrifuged in heteropolytungstate solution (LST Fastfloat) at densities of 2.62 and 2.74 g/cm^3. The 2.62 - 2.74 g/cm^3 fraction was treated with 40% Hydrofluoric acid (HF) for 40 minutes, to dissolve less chemically resistant minerals with a similar density to quartz, and to etch the outer part of the quartz grains, which would have absorbed external alpha radiation during burial. The HF etched material was then treated with 1 M HCl for 10 minutes to dissolve any precipitated fluorides, and re-sieved at 90 μm with ultrasonic agitation to wash off any residual mineral dust. This etched quartz material was dried at 50°C, and dispensed in ~4 mg aliquots onto the central part of 1 cm diameter, 0.25 mm thick stainless steel disks, using silicone oil for adhesion. 16 disks were made per sample.

4.2. Measurements and determinations

4.2.1. Dose rate measurements and determinations

Dose rates were measured in the laboratory using High Resolution Gamma Spectrometry (HRGS) and Thick Source Beta Counting (TSBC). In-situ gamma spectra were measured using a Field Gamma Spectrometer (FGS) by Professor Ian Simpson, at the time of sampling. Full sets of dose rate determinations were made for all samples except SUTL 2225.

FGS measurements were made using an Ortec DigiBASE spectrometer pack with a 2"x 2" NaI probe. Prior to 2006 fieldwork, measurements were made using this system on the doped concrete reference pads at SUERC in order to provide cross-reference to dose-rate conversion factors established by Sanderson (1986), based on comparisons with TL dosimetry in doped blocks then at the Oxford and Risø luminescence laboratories. The spectra were calibrated to the 1461 keV peak from ^{40}K and the 2614.5 keV peak from ^{208}Tl, then dose rates were determined from integral counts >450 keV, >1350 keV. Using this approach yielded dose rates from the pads that were on average within 2% and 5% of those expected for the >450 keV and >1350 keV integrals. Field spectra were each measured for 1 hr in holes cut around the luminescence sampling positions using an over-tube, and calibrated to the 1461 keV peak from ^{40}K and the 2614.5 keV peak from ^{208}Tl before calculation of dose rates. A single FGS measurement was made for samples SUTL 2223, 2224 and 2225, which were taken in close proximity to each other.

HRGS measurements were performed using a 50% relative efficiency "n" type hyper-pure Ge detector (EG&G Ortec Gamma-X) operated in a low background lead shield with a copper liner. Gamma ray spectra were recorded over the 30 keV to 3 MeV range from each sample, interleaved with background measurements and measurements from Shap Granite in the same geometries. Counting times of 25, 50, and 80 ks per sample were used according to the quantity of material available from each sample. The spectra were analysed to determine count rates from the major line emissions from ^{40}K (1457 keV), and from selected nuclides in the U decay series (^{234}Th, ^{226}Ra + ^{235}U, ^{214}Pb, ^{214Bi} and ^{210}Pb) and the Th decay series (^{228}Ac, ^{212}Pb, ^{208}Tl) and their statistical counting uncertainties. Net rates and activity concentrations for each of these nuclides were determined relative to Shap Granite by weighted combination of the individual lines for each nuclide. The internal consistency of nuclide specific estimates for U and Th decay series nuclides was assessed relative to measurement precision, and weighted combinations used to estimate mean activity concentrations (in Bq kg^{-1}) and elemental concentrations (% K and ppm U, Th) for the parent activity. These data were used to determine infinite matrix dose rates for alpha, beta and gamma radiation.

Beta dose rates were also measured directly using the SUERC TSBC system (Sanderson, 1988). Sample count rates were determined with six replicate 600 s counts for each sample, bracketed by background measurements and sensitivity determinations using the SUERC Shap Granite secondary reference material. Infinite-matrix dose rates were calculated by scaling the net count rates of samples and

reference material to the working beta dose rate of the Shap Granite (6.25±0.03 mGy a^{-1}). The estimated errors combine counting statistics, observed variance and the uncertainty on the reference value.

"Field", "saturated", and "drained upper limit" (DUL; Ratiff *et al*., 1983) values of water content (section 4.1) were calculated as fractions of dry sediment mass after subtracting the mass of the tube and gauze. An assumed value for the average water content during burial was calculated as the average of the field and DUL water contents, except for samples SUTL 2220 and 2221 for which field notes indicated regular saturation. The dose rate estimates were used in combination with the assumed burial water contents, to determine the overall effective dose rates for age estimation.

The cosmic dose rate was estimated as follows. The latitude, altitude and (sediment) depth dependencies of cosmic radiation, relevant to luminescence dating, are described by Prescott and Stephan (1982) and Prescott and Hutton (1988). In the present study, the latitude of each sample was approximated to the nearest degree, and altitude was approximated as 0.1 km for all. Surface cosmic dose rate was estimated using Prescott and Stephan (1982), Eqn. 1, with latitude dependent parameters read from Fig. 2. A representative value for the average burial depth of each sample since the luminescence signal was last zeroed, was estimated from depth at the time of sampling, geomorphological context, and approximate luminescence age. Depth was converted to mass-depth assuming sediment bulk density to be 1.6 g/cm^3, and a fit to the dose rate vs. depth data of Prescott and Hutton (1988) was used to calculate the cosmic dose rate at that depth. Uncertainties were calculated as: 5% plus the difference between cosmic dose rate at the depth of sampling, and that at the estimated average burial depth.

4.2.2. Luminescence measurements

All measurements were conducted using Risø DA-15 automatic readers. Each was equipped with a $^{90}Sr/^{90}Y$ β-source for irradiation, blue LEDs emitting around 470 nm and infrared (laser) diodes emitting around 830 nm for optical stimulation, and a U340 detection filter pack to detect in the region 270-380 nm, while cutting out stimulating light (Bøtter-Jensen *et al*., 2000).

The discs of quartz grains from the tube samples were subjected to a single aliquot regeneration (SAR) sequence (Murray and Wintle, 2000). According to this procedure, the OSL signal level from an individual disc is calibrated to provide an absorbed dose estimate using an interpolated dose-response curve, constructed by regenerating OSL signals by irradiation in the laboratory. This estimate is termed the equivalent dose (De), since it is the laboratory dose producing an equivalent signal to that observed from the natural sample. Sensitivity changes which may occur as a result of readout, irradiation and preheating (to remove unstable radiation-induced signals) are monitored using small test doses after each regenerative dose. Each measurement is standardised to the test dose response determined immediately after its readout, thus compensating for observed changes in sensitivity during the laboratory measurement sequence.

In a SAR sequence then, each disc is subject to a number of measurement cycles: Natural&Test (cycle 1), Regenerative&Test (cycle 2), Regenerative&Test (cycle 3), etc., where all that is varied is the regenerative dose. For the purposes of interpolation, the regenerative doses are chosen to encompass the likely value of the equivalent (natural) dose. A repeat dose point is included to check the ability of the SAR procedure to correct for laboratory-induced sensitivity changes, a zero dose point is included late in the sequence to check for recuperative signals, and a repeat point with infrared stimulation prior to the OSL measurement is included to check for non-quartz signal ("Recycling", "Zero", "IRRecycling"; Table 4.1). Quartz responds to blue light but generally not to infrared light, whereas other common minerals such as feldspars and zircon respond to both. Additionally, results may vary with the severity of the preheating employed: this is tested for by applying a range of preheats to different groups within the set of discs.

In the present study 16 discs per sample were measured using 4 discs each at 4 different preheats (Table 4.1). A slowly decaying component in the OSL signals appeared to come from traps producing TL in the range 200-280°C: differential effects such as variations in De vs. time were reduced by matching the test and regenerative preheats. Regenerative doses of 0 to 15 Gy were applied to all samples (plus repeats etc.: cycles 1 to 9, Table 4.1).

26 of the 31 submitted samples were selected (by Professor I Simpson) for De determination.

Table 4.1. Quartz Single Aliquot Regenerative Sequence

		Measurement Cycle:	1	2	3	4	5	6	7	8	9	10
Aliquots	**Operation**	**Details**	Natural		Linear-spaced doses					Zero	Recycling	IR Recycling
1-16	Regenerative Dose	"X" Gy $^{90}Sr/^{90}Y$	no	6	0	3	9	12	15	0	6	6
1-4	Preheat	220°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4-8	Preheat	240°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
9-12	Preheat	260°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
13-16	Preheat	280°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
1-16	Measurement	IRSL 120s at 50°C	no	no	no	no	no	no	no	no	no	yes
1-16	Measurement	OSL 60s at 125°C	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
1-16	Test Dose	"X" Gy $^{90}Sr/^{90}Y$	1	1	1	1	1	1	1	1	1	1
1-4	Test Preheat	220°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
4-8	Test Preheat	240°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
9-12	Test Preheat	260°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
13-16	Test Preheat	280°C for 30s	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
1-16	Test Measurement	OSL 60s at 125°C	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

5. Results

5.1. Dose rates

HGRS results are shown in Table 5.1, both as activity concentrations (i.e. disintegrations per second per kilogram) and as equivalent parent element concentrations (in % and ppm), based in the case of U and Th on combining nuclide specific data assuming decay series equilibrium. K concentrations ranged from 0.5 to 3.4 %, the mean was 1.8 % ± 0.7. U concentrations ranged from 0.5 to 1.8 ppm, the mean was 1.2 ppm ± 0.3. Th concentrations ranged from 2.9 to 20.1 ppm, the mean was 8.2 ppm ± 3.8. The concentration ratio Th/U is also listed in Table 5.1, to indicate the relative contribution of Th and U to the samples' dose rates. Th/U for the present samples ranged from 3.6 to 16.6, with a mean value of 7.3 ± 3.1.

Infinite matrix alpha, beta and gamma dose rates from HGRS are listed in Table 5.2, with in-situ gamma dose rates from FGS, infinite matrix beta dose rates from TSBC, and the ratio of beta dose rates from TSBC/HGRS. In-situ gamma dose rate (FGS) ranged from 0.33 to 1.59 mGy/a, the mean was 0.76 mGy/a ± 0.26. Gamma dose rate measured on a dry sample in the laboratory (HGRS) ranged from 0.41 to 2.02 mGy/a, the mean was 0.99 mGy/a ± 0.33. Beta dose rate from HGRS ranged from 0.75 to 3.61 mGy/a, the mean was 1.91 mGy/a ± 0.65. Beta dose rate from TSBC ranged from 0.85 to 4.75 mGy/a, the mean was 2.24 mGy/a ± 0.82. Alpha dose rate (HGRS) ranged from 3.8 to 19.0 mGy/a, the mean was 9.3 mGy/a ± 3.4. The ratio of beta dose rates from TSBC and HGRS ranged from 0.9 to 1.5 (plus one outlying value of 2.2 from SUTL 2218) the mean was 1.15 ± 0.03 (discussed in section 6.2).

Effective dose rates to the HF etched 120 μm quartz grains used for equivalent dose determination in the present study are listed in Table 5.3, with water content measurements and the assumed values used for calculation of effective dose rate. Etching removes the external alpha contribution to the dose rate (so these are not tabulated), and 10 % of the beta dose rate. Cosmic dose rates are as calculated (section 4.2.1), gamma dose rates are corrected for water content, while beta dose rates are corrected for etching and water content.

Field water content, as a fraction of dry sediment mass, ranged from 0.02 to 0.15, the mean was 0.07 ± 0.03 (the value for SUTL 2103 is interpolated). Saturated water content ranged from 0.15 to 0.60, the mean was 0.27 ± 0.11. The drained upper limit (DUL) of water content ranged from 0.11 to 0.57, the mean was 0.23 ± 0.11. The field water contents were assumed to be low relative to the average the sample experienced during burial, such that for most samples the average value was most likely to lie between the measured field and DUL values. However, field notes indicated that samples 2220 and 2221 would have been subject to regular saturation so the Sat. values were considered to be the upper bounds for these. Assumed values for average water content during burial were estimated accordingly, and used for age determinations. These ranged from 0.08 to 0.34, the mean was 0.15 ± 0.06.

The ratio of gamma dose rates from FGS and HGRS, after adjustment for assumed levels of water content, ranged from 0.71 to 1.03 (plus one outlying value from SUTL 2218 of 1.56) the mean was 0.80 ± 0.08 (discussed in section 6.2).

To accommodate the range of likely sample conditions during burial, the weighted means of the TSBC and HGRS values, and the FGS and HRGS values, were used for the calculation of effective beta and gamma dose rates to the samples, with "external error" values (e.g. Burbidge *et al.*, 2006). The HGRS determinations from SUTL 2218 were inconsistent with the FGS and TSBC results (discussed in section 6.2), so for this sample the TSBC values were used in the calculation of effective beta dose rate, and the FGS values were used in the calculation of effective gamma dose rate. Effective beta dose rate ranged from 0.55 to 3.14 mGy/a, the mean was 1.61 mGy/a ± 0.58. Effective gamma dose rate ranged from 0.27 to 1.56 mGy/a, the mean was 0.76 mGy/a ± 0.27. Effective cosmic dose rate ranged from 0.14 to 0.27 mGy/a, the mean was 0.21 mGy/a ± 0.03. On average, the beta contribution to overall dose rate was 62 %, the gamma contribution was 30 %, and the cosmic contribution was 8 %.

Table 5.1. Activity and equivalent concentrations of K, U and Th, determined by HRGS

SUTL	Activity Concentration			Equivalent Concentration[a,b]			
No.	K (Bq/kg)	U (Bq/kg)	Th (Bq/kg)	K (%)	U (ppm)	Th (ppm)	Th/U
2090	520 ± 16	18.08 ± 0.90	35.32 ± 1.07	1.68 ± 0.05	1.46 ± 0.07	8.71 ± 0.26	5.95 ± 0.35
2091	483 ± 14	18.01 ± 1.05	35.03 ± 0.78	1.56 ± 0.05	1.46 ± 0.08	8.64 ± 0.19	5.92 ± 0.37
2092	547 ± 21	18.02 ± 1.32	32.13 ± 1.59	1.77 ± 0.07	1.46 ± 0.11	7.92 ± 0.39	5.42 ± 0.48
2093	608 ± 19	16.64 ± 1.29	38.83 ± 1.09	1.96 ± 0.06	1.35 ± 0.10	9.57 ± 0.27	7.10 ± 0.59
2094	803 ± 21	17.64 ± 0.79	45.23 ± 1.19	2.60 ± 0.07	1.43 ± 0.06	11.15 ± 0.29	7.80 ± 0.41
2095	763 ± 17	14.48 ± 0.84	37.62 ± 0.78	2.47 ± 0.05	1.17 ± 0.07	9.27 ± 0.19	7.91 ± 0.49
2096	563 ± 22	12.61 ± 2.12	38.80 ± 2.10	1.82 ± 0.07	1.02 ± 0.17	9.56 ± 0.52	9.36 ± 1.65
2097	581 ± 18	12.16 ± 1.03	39.18 ± 1.72	1.88 ± 0.06	0.99 ± 0.08	9.66 ± 0.42	9.80 ± 0.93
2098	432 ± 14	12.28 ± 0.86	30.76 ± 0.80	1.40 ± 0.04	0.99 ± 0.07	7.58 ± 0.20	7.63 ± 0.57
2099	376 ± 15	9.00 ± 0.87	18.72 ± 1.31	1.22 ± 0.05	0.73 ± 0.07	4.62 ± 0.32	6.33 ± 0.76
2100	431 ± 22	17.77 ± 2.06	38.48 ± 2.62	1.39 ± 0.07	1.44 ± 0.17	9.48 ± 0.65	6.59 ± 0.89
2101	456 ± 14	12.55 ± 0.94	23.80 ± 0.79	1.47 ± 0.05	1.02 ± 0.08	5.87 ± 0.19	5.77 ± 0.47
2102	431 ± 20	10.54 ± 1.45	20.53 ± 1.83	1.39 ± 0.07	0.85 ± 0.12	5.06 ± 0.45	5.93 ± 0.97
2103	320 ± 18	13.25 ± 1.40	20.71 ± 1.72	1.03 ± 0.06	1.07 ± 0.11	5.10 ± 0.42	4.76 ± 0.64
2104	424 ± 15	15.43 ± 0.83	23.23 ± 0.94	1.37 ± 0.05	1.25 ± 0.07	5.73 ± 0.23	4.58 ± 0.31
2105	352 ± 15	18.23 ± 1.19	21.61 ± 1.32	1.14 ± 0.05	1.48 ± 0.10	5.33 ± 0.33	3.61 ± 0.32
2106	255 ± 21	7.20 ± 2.74	11.78 ± 2.42	0.82 ± 0.07	0.58 ± 0.22	2.90 ± 0.60	4.98 ± 2.16
2214	645 ± 13	21.63 ± 0.62	60.23 ± 0.61	2.08 ± 0.04	1.75 ± 0.05	14.84 ± 0.15	8.47 ± 0.26
2215	650 ± 17	19.03 ± 1.08	43.89 ± 1.06	2.10 ± 0.06	1.54 ± 0.09	10.82 ± 0.26	7.02 ± 0.43
2216	1048 ± 29	18.44 ± 1.97	81.45 ± 2.77	3.39 ± 0.09	1.49 ± 0.16	20.08 ± 0.68	13.45 ± 1.51
2217	566 ± 16	15.77 ± 0.73	67.85 ± 1.19	1.83 ± 0.05	1.28 ± 0.06	16.72 ± 0.29	13.10 ± 0.65
2218	144 ± 7	7.20 ± 0.25	39.22 ± 0.42	0.47 ± 0.02	0.58 ± 0.02	9.67 ± 0.10	16.57 ± 0.60
2219	455 ± 14	11.11 ± 0.81	37.31 ± 0.96	1.47 ± 0.05	0.90 ± 0.07	9.20 ± 0.24	10.22 ± 0.79
2220	344 ± 13	6.66 ± 0.42	20.11 ± 0.55	1.11 ± 0.04	0.54 ± 0.03	4.96 ± 0.13	9.18 ± 0.63
2221	468 ± 20	10.66 ± 1.46	31.73 ± 1.70	1.51 ± 0.06	0.86 ± 0.12	7.82 ± 0.42	9.06 ± 1.33
2222	810 ± 14	16.25 ± 0.47	23.66 ± 0.33	2.62 ± 0.05	1.32 ± 0.04	5.83 ± 0.08	4.43 ± 0.14
2223	925 ± 20	18.29 ± 1.05	24.65 ± 0.85	2.99 ± 0.07	1.48 ± 0.08	6.08 ± 0.21	4.10 ± 0.27
2224	925 ± 20	18.29 ± 1.05	24.65 ± 0.85	2.99 ± 0.07	1.48 ± 0.08	6.08 ± 0.21	4.10 ± 0.27
2226	814 ± 19	13.79 ± 0.66	20.09 ± 0.58	2.63 ± 0.06	1.12 ± 0.05	4.95 ± 0.14	4.43 ± 0.25
2227	700 ± 23	8.92 ± 1.38	14.41 ± 1.43	2.26 ± 0.08	0.72 ± 0.11	3.55 ± 0.35	4.92 ± 0.91
Shap	1370 ± 10	148.2 ± 7.4	115.6 ± 1.1	4.43 ± 0.03	12.00 ± 0.06	28.50 ± 0.26	2.38 ± 0.02

a. Conversion factors based on OECD (1994): ^{40}K: 309.3 Bq/kg/%K, ^{238}U: 12.35 Bq/kg/ppmU, ^{232}Th: 4.057 Bq/kg/ppmTh.

b. Shap granite reference, working values based on HRGS relative to CANMET and NBL standards by Sanderson (1986).

Table 5.2. Insitu gamma dose rate measured using FGS, and infinite matrix dose rates determined by HRGS and TSBC in the laboratory.

SUTL	FGS, In-Situ[a]	HRGS, Dry [b]			TSBC, Dry [c]	TSBC/HRGS
No.	Gamma (mGy/a)	Alpha (mGy/a)	Beta (mGy/a)	Gamma (mGy/a)	Beta (mGy/a)	Beta Ratio
2090	0.75 ± 0.02	10.50 ± 0.28	1.86 ± 0.05	1.02 ± 0.02	2.16 ± 0.06	1.16 ± 0.04
2091	0.70 ± 0.02	10.43 ± 0.27	1.76 ± 0.04	0.99 ± 0.02	1.86 ± 0.06	1.06 ± 0.04
2092	0.70 ± 0.02	9.91 ± 0.41	1.91 ± 0.06	1.00 ± 0.03	2.10 ± 0.06	1.10 ± 0.05
2093	0.79 ± 0.02	10.82 ± 0.35	2.10 ± 0.05	1.12 ± 0.02	2.67 ± 0.06	1.27 ± 0.04
2094	0.97 ± 0.02	12.21 ± 0.28	2.68 ± 0.06	1.36 ± 0.02	2.98 ± 0.07	1.11 ± 0.04
2095	0.88 ± 0.02	10.11 ± 0.24	2.48 ± 0.05	1.21 ± 0.02	2.74 ± 0.07	1.10 ± 0.03
2096	0.69 ± 0.02	9.91 ± 0.61	1.93 ± 0.07	1.05 ± 0.04	1.85 ± 0.06	0.96 ± 0.04
2097	0.72 ± 0.02	9.87 ± 0.39	1.98 ± 0.05	1.06 ± 0.03	2.24 ± 0.06	1.13 ± 0.04
2098	*0.72 ± 0.02*	8.37 ± 0.24	1.52 ± 0.04	0.84 ± 0.02	2.03 ± 0.06	1.33 ± 0.05
2099	0.43 ± 0.01	5.44 ± 0.31	1.25 ± 0.04	0.61 ± 0.02	1.40 ± 0.05	1.13 ± 0.06
2100	0.66 ± 0.02	11.01 ± 0.67	1.64 ± 0.07	0.99 ± 0.04	1.80 ± 0.05	1.10 ± 0.06
2101	0.54 ± 0.01	7.16 ± 0.26	1.54 ± 0.04	0.77 ± 0.02	1.70 ± 0.05	1.10 ± 0.04
2102	0.51 ± 0.01	6.11 ± 0.47	1.43 ± 0.06	0.69 ± 0.03	1.48 ± 0.05	1.03 ± 0.06
2103	0.50 ± 0.01	6.76 ± 0.44	1.16 ± 0.05	0.63 ± 0.03	1.42 ± 0.05	1.22 ± 0.07
2104	0.53 ± 0.01	7.70 ± 0.25	1.48 ± 0.04	0.77 ± 0.02	1.54 ± 0.05	1.04 ± 0.04
2105	0.53 ± 0.01	8.04 ± 0.36	1.31 ± 0.04	0.72 ± 0.02	1.52 ± 0.05	1.16 ± 0.05
2106	0.33 ± 0.01	3.77 ± 0.76	0.85 ± 0.07	0.41 ± 0.04	0.85 ± 0.04	1.00 ± 0.09
2214	1.18 ± 0.04	15.84 ± 0.18	2.41 ± 0.03	1.47 ± 0.01	3.02 ± 0.06	1.25 ± 0.03
2215	0.88 ± 0.03	12.28 ± 0.31	2.28 ± 0.05	1.24 ± 0.02	2.46 ± 0.06	1.08 ± 0.04
2216	1.59 ± 0.06	18.99 ± 0.67	3.61 ± 0.08	2.02 ± 0.05	4.75 ± 0.08	1.32 ± 0.04
2217	1.28 ± 0.04	15.91 ± 0.27	2.18 ± 0.04	1.45 ± 0.02	3.35 ± 0.07	1.53 ± 0.05
2218	1.02 ± 0.04	8.76 ± 0.09	0.75 ± 0.02	0.68 ± 0.01	1.63 ± 0.05	2.17 ± 0.09
2219	0.61 ± 0.02	9.30 ± 0.25	1.62 ± 0.04	0.93 ± 0.02	1.67 ± 0.05	1.03 ± 0.04
2220	0.58 ± 0.02	5.16 ± 0.14	1.14 ± 0.03	0.58 ± 0.01	1.49 ± 0.05	1.30 ± 0.06
2221	0.62 ± 0.02	8.18 ± 0.45	1.61 ± 0.06	0.87 ± 0.03	1.50 ± 0.05	0.93 ± 0.05
2222	0.81 ± 0.03	7.97 ± 0.12	2.53 ± 0.04	1.08 ± 0.01	2.90 ± 0.06	1.14 ± 0.03
2223	0.84 ± 0.03	8.61 ± 0.28	2.87 ± 0.06	1.20 ± 0.02	3.14 ± 0.07	1.09 ± 0.03
2224	0.84 ± 0.03	8.61 ± 0.28	2.87 ± 0.06	1.20 ± 0.02	3.02 ± 0.06	1.05 ± 0.03
2226	0.84 ± 0.03	6.76 ± 0.18	2.49 ± 0.05	1.02 ± 0.02	3.14 ± 0.07	1.26 ± 0.04
2227	0.77 ± 0.03	4.63 ± 0.41	2.09 ± 0.07	0.81 ± 0.03	2.68 ± 0.06	1.28 ± 0.05

a. Values in italics are interpolated b. Based on Dose Rate conversion factors from Aitken (1983).
c. Relative to Shap granite reference (Sanderson, 1986).

Table 5.3. Water contents and effective dose rates

SUTL	Water Content (frn. of dry mass)				Gamma, Assumed WC		Effective Dose Rate (mGy/a)		
No.	Field	Sat.	DUL	Assumed[a]	FGS (mGy/a)	HGRS (mGy/a)	Beta[b]	Gamma[c]	Cosmic[d]
2090	0.07	0.21	0.20	0.14 ± 0.05	0.70 ± 0.03	0.88 ± 0.04	1.55 ± 0.09	0.77 ± 0.06	0.21 ± 0.01
2091	0.06	0.24	0.24	0.15 ± 0.06	0.64 ± 0.04	0.84 ± 0.05	1.39 ± 0.02	0.71 ± 0.06	0.19 ± 0.01
2092	0.03	0.25	0.24	0.13 ± 0.07	0.62 ± 0.04	0.87 ± 0.06	1.57 ± 0.05	0.70 ± 0.07	0.27 ± 0.03
2093	0.05	0.16	0.16	0.11 ± 0.04	0.74 ± 0.03	1.00 ± 0.04	1.87 ± 0.18	0.83 ± 0.08	0.25 ± 0.04
2094	0.06	0.16	0.15	0.11 ± 0.03	0.92 ± 0.03	1.22 ± 0.04	2.28 ± 0.07	1.04 ± 0.09	0.25 ± 0.04
2095	0.08	0.23	0.22	0.15 ± 0.05	0.81 ± 0.04	1.03 ± 0.05	2.01 ± 0.05	0.89 ± 0.07	0.23 ± 0.04
2096	0.08	0.30	0.28	0.18 ± 0.07	0.62 ± 0.04	0.87 ± 0.06	1.42 ± 0.06	0.69 ± 0.06	0.19 ± 0.01
2097	0.15	0.29	0.28	0.21 ± 0.04	0.67 ± 0.03	0.85 ± 0.04	1.52 ± 0.06	0.73 ± 0.05	0.19 ± 0.03
2098	0.12	0.30	0.28	0.20 ± 0.06	0.67 ± 0.04	0.68 ± 0.04	1.24 ± 0.15	0.68 ± 0.03	0.19 ± 0.03
2099	0.09	0.33	0.32	0.21 ± 0.08	0.38 ± 0.03	0.50 ± 0.04	0.96 ± 0.04	0.42 ± 0.04	0.22 ± 0.04
2100	0.05	0.22	0.21	0.13 ± 0.06	0.61 ± 0.03	0.86 ± 0.06	1.35 ± 0.04	0.67 ± 0.06	0.23 ± 0.04
2101	0.07	0.46	0.45	0.26 ± 0.13	0.45 ± 0.06	0.60 ± 0.08	1.12 ± 0.03	0.50 ± 0.05	0.22 ± 0.04
2102	0.06	0.15	0.14	0.10 ± 0.03	0.49 ± 0.02	0.62 ± 0.03	1.18 ± 0.01	0.51 ± 0.03	0.16 ± 0.01
2103	*0.10*	0.50	0.49	0.30 ± 0.14	0.41 ± 0.05	0.47 ± 0.07	0.85 ± 0.07	0.43 ± 0.04	0.15 ± 0.01
2104	0.07	0.15	0.15	0.11 ± 0.03	0.51 ± 0.02	0.68 ± 0.02	1.22 ± 0.00	0.57 ± 0.05	0.14 ± 0.01
2105	0.10	0.19	0.18	0.14 ± 0.03	0.51 ± 0.02	0.62 ± 0.03	1.09 ± 0.06	0.54 ± 0.03	0.14 ± 0.01
2106	0.10	0.60	0.57	0.34 ± 0.16	0.26 ± 0.04	0.30 ± 0.06	0.55 ± 0.01	0.27 ± 0.03	0.25 ± 0.04
2214	0.05	0.28	0.21	0.13 ± 0.06	1.08 ± 0.06	1.28 ± 0.07	2.06 ± 0.19	1.18 ± 0.08	0.22 ± 0.04
2215	0.09	0.33	0.25	0.17 ± 0.06	0.81 ± 0.05	1.04 ± 0.06	1.78 ± 0.03	0.90 ± 0.08	0.20 ± 0.03
2216	0.05	0.36	0.24	0.14 ± 0.07	1.43 ± 0.10	1.73 ± 0.12	3.14 ± 0.37	1.56 ± 0.12	0.25 ± 0.03
2217	0.02	0.22	0.17	0.09 ± 0.05	1.18 ± 0.07	1.31 ± 0.06	2.04 ± 0.39	1.25 ± 0.06	0.23 ± 0.04
2218	0.03	0.28	0.19	0.11 ± 0.06	0.94 ± 0.05	0.60 ± 0.03	*1.29 ± 0.07*	*0.94 ± 0.05*	0.22 ± 0.04
2219	0.12	0.35	0.31	0.21 ± 0.06	0.55 ± 0.04	0.75 ± 0.05	1.19 ± 0.00	0.62 ± 0.06	0.26 ± 0.03
2220	0.04	0.20	0.11	*0.12 ± 0.06*	0.53 ± 0.03	0.51 ± 0.03	1.01 ± 0.11	0.52 ± 0.02	0.21 ± 0.03
2221	0.06	0.19	0.12	*0.12 ± 0.05*	0.58 ± 0.03	0.76 ± 0.04	1.23 ± 0.07	0.64 ± 0.06	0.20 ± 0.03
2222	0.03	0.16	0.14	0.08 ± 0.04	0.76 ± 0.04	0.99 ± 0.04	2.23 ± 0.09	0.88 ± 0.08	0.20 ± 0.01
2223	0.05	0.28	0.22	0.13 ± 0.06	0.76 ± 0.05	1.05 ± 0.06	2.37 ± 0.04	0.87 ± 0.09	0.20 ± 0.01
2224	0.05	0.20	0.15	0.10 ± 0.04	0.76 ± 0.05	1.08 ± 0.04	2.42 ± 0.00	0.95 ± 0.12	0.19 ± 0.01
2226	0.03	0.17	0.14	0.09 ± 0.04	0.79 ± 0.04	0.93 ± 0.04	2.27 ± 0.20	0.86 ± 0.05	0.19 ± 0.01
2227	0.02	0.22	0.15	0.09 ± 0.05	0.71 ± 0.04	0.74 ± 0.04	1.94 ± 0.19	0.73 ± 0.03	0.18 ± 0.01

a. Assumed water content = (Field + DUL)/2 ± |Assumed - Field|/2^0.5, values in italics calculated using Sat. in place of DUL

b. Calculated using the weighted mean of the effective beta dose rates measured using HRGS and TSBC:
effective beta dose rate = 0.9*infinite beta dose rate/(1+1.25*water content). 0.9 is the average
beta attenuation in a 100 micron silicate grain (Mejdahl, 1979). Except 2218: TSBC only.

c. Calculated using the weighted mean of the gamma dose rates corrected for assumed water content measured using HRGS and FGS:
Effective gamma dose rate = gamma dose rate/(1+1.14*WCassumed-WCas-measured).
WCas-measured = Field for FGS, = 0 for HGRS. Except 2218: FGS only.
For the energies found in a typical sedimentary matrix, water absorbs approximately 1.25 times
more beta, and 1.14 times more gamma radiation per unit mass than do silicates (Aitken, 1985).

d. Calculated from latitude, altitude, and estimated average depth during burial, using the data of
Prescott and Stephan (1982) and Prescott and Hutton (1988).

5.2. Single aliquot equivalent dose determinations

Sample averaged values relating to the aliquots and measurements used for equivalent dose determination are listed in Table 5.4: aliquot by aliquot breakdowns can be found in Appendix D. The average mass of 90 - 150 μm grains on each disk was 2.9 mg, equivalent to c. 1200 grains. The average sensitivity of the OSL signal from these samples to radiation ranged from 827 to 2532 cps/mg/Gy, the mean was 1828 cps/mg/Gy ± 500. With repeated SAR measurement cycles, this sensitivity changed to between 1.1 and 2.0 times the starting values, the mean being 1.6 ± 0.2 times. With respect to the internal checks on SAR performance: average recycling ratio for each sample ranged between 0.87 and 1.05, with a mean of 0.95 ± 0.04, and the effect of IRSL exposure on this ratio was to produce a range of 0.86 to 1.05, with a mean of 0.94 ± 0.05.

Average zero dose response as a fraction of the recycling dose response ranged from 0.01 to 0.09; the mean was 0.04 ± 0.02. This indicates residual signals due to accumulated charge transfer during the SAR run equivalent to 0.25 ± 0.13 Gy, which is a significant fraction of some of the equivalent doses determined in the present study. However, the zero dose ratio in Table 5.4 was measured following the largest dose, late in the measurement sequence (Table 4.1), in order to maximise any effect. A zero dose point was also measured early in the sequence and yielded lower values (App. D): these were used to define the growth curve for De determination.

For equivalent dose determination, data from single aliquot regenerative dose measurements were analysed using the Risø Analyst programme, which fitted individual dose response curves and estimated equivalent dose values for each of the measured disks. A saturating exponential curve was fitted to all the measured points except the "IRRecycling" point and the second zero dose response (section 4.2.2). No consistent patterns of variation in De with preheat were apparent (Appendix D). Results from all measured disks were used in the estimation of central De values. Arithmetic mean De values are listed for each sample in Table 5.4, with the "external" uncertainty on the mean value (standard deviation divided by the square root of the number of disks), the standard deviation of the dataset, and "internal uncertainty" on the mean value (errors propagated through the calculation of the mean). The mean De values range from 0.3 to 33 Gy, the average is 6.8 Gy ± 6.7. However, examination of the distributions of results from individual aliquots (Appendix D) indicated that some of the mean values were affected by scatter in the data.

The luminescence sensitivity of the Anuradhapura samples was relatively high, so uncertainties on De values for individual aliquots were relatively low: errors propagated from integral counts and interpolation were often less than 1% of the De values (Appendix D). Scatter in samples' De distributions could not therefore be explained by measured uncertainties (indicating that it was "genuine"), so the "H15 Robust Mean" (RSC, 2001) was used to estimate a central De value for each sample. The H15 Robust Mean estimate is calculated iteratively by down weighting data outwith 1.5 standard deviations, but weighting data equally within this range. This yields a central estimate that is less sensitive to outliers than the arithmetic mean, and is still associated with a standard error estimate (unlike e.g. the Median).

Table 5.4. Equivalent dose determination: samples and results

SUTL	Reader		Ali. Mass	Sensitivity	Sensitivity	Recycling	Post IRSL	Zero Dose	Mean De[a,b,c]				Robust Mean De[b,d]				σ/N$^{1/2}$	Notes[e]
No.	Risø	N	(g)[a]	(cps/mg/Gy)[a]	Change (frn.)[a]	Ratio[a]	Ratio[a]	Ratio[a]	(Gy)	σ/N$^{1/2}$	σ	pe	Type	N	(Gy)	σ/N$^{1/2}$	σ	/ pe	
2091	1	16	3.8 ± 0.1	1928 ± 90	1.86 ± 0.04	0.91 ± 0.01	0.91 ± 0.01	0.065 ± 0.002	3.81 ± 0.08	0.31	0.01	H15 mean	16	3.81 ± 0.09	0.35	11	=	
2093	1	16	2.0 ± 0.1	1394 ± 111	1.61 ± 0.03	0.94 ± 0.01	0.92 ± 0.01	0.043 ± 0.002	2.42 ± 0.08	0.33	0.01	H15 mean	16	2.37 ± 0.06	0.26	7	=	
2094	1	16	2.5 ± 0.2	2154 ± 101	1.49 ± 0.02	0.95 ± 0.01	0.94 ± 0.01	0.036 ± 0.002	1.33 ± 0.09	0.36	0.00	H15 mean	16	1.26 ± 0.06	0.22	15	>	
2095	1	16	3.7 ± 0.2	2399 ± 98	1.51 ± 0.03	0.95 ± 0.01	0.95 ± 0.01	0.035 ± 0.002	2.93 ± 0.21	0.83	0.01	H15 mean	16	2.76 ± 0.10	0.39	16	>	
2097	1	16	4.0 ± 0.3	2244 ± 92	1.34 ± 0.02	0.96 ± 0.01	0.96 ± 0.01	0.031 ± 0.002	7.67 ± 1.72	6.88	0.03	H15 mean	16	5.92 ± 0.21	0.83	8	=	
2098	1	16	4.3 ± 0.2	2198 ± 40	1.26 ± 0.02	0.99 ± 0.01	0.98 ± 0.01	0.017 ± 0.001	7.99 ± 0.37	1.48	0.02	H15 mean	16	7.66 ± 0.18	0.71	11	=	
2099	1	16	1.7 ± 0.1	1775 ± 106	1.48 ± 0.03	0.99 ± 0.01	0.98 ± 0.01	0.014 ± 0.001	1.78 ± 0.15	0.62	0.01	H15 mean	16	1.64 ± 0.07	0.27	11	=	
2101	1	16	2.3 ± 0.1	2465 ± 79	1.22 ± 0.02	0.98 ± 0.01	0.97 ± 0.01	0.018 ± 0.001	13.90 ± 0.47	1.90	0.04	H15 mean	16	13.88 ± 0.53	2.11	14		
2102	1	16	1.4 ± 0.1	1677 ± 159	1.68 ± 0.04	0.91 ± 0.01	0.90 ± 0.01	0.084 ± 0.006	12.20 ± 0.66	2.62	0.07	H15 mean	16	12.18 ± 0.68	2.72	10		
2103	1	16	3.1 ± 0.2	1946 ± 103	1.79 ± 0.03	0.89 ± 0.01	0.87 ± 0.01	0.093 ± 0.003	9.06 ± 0.55	2.19	0.03	H15 mean	16	9.05 ± 0.60	2.40	21		
2104	1	16	4.7 ± 0.3	2015 ± 99	1.68 ± 0.02	0.92 ± 0.01	0.90 ± 0.01	0.039 ± 0.002	10.86 ± 0.38	1.52	0.03	H15 mean	16	10.84 ± 0.39	1.56	14	=	
2105	1	16	4.2 ± 0.2	2020 ± 78	1.74 ± 0.02	0.91 ± 0.01	0.89 ± 0.01	0.042 ± 0.002	10.29 ± 0.34	1.37	0.03	H15 mean	16	10.23 ± 0.36	1.43	14	=	
2106	1	16	0.9 ± 0.1	1486 ± 451	2.04 ± 0.10	0.90 ± 0.01	0.88 ± 0.01	0.080 ± 0.008	1.10 ± 0.15	0.60	0.01	H15 mean	16	0.98 ± 0.07	0.26	6	>	
2214	1	16	2.8 ± 0.2	1801 ± 120	1.74 ± 0.02	0.96 ± 0.01	0.96 ± 0.01	0.039 ± 0.002	3.64 ± 0.09	0.34	0.01	H15 mean	16	3.59 ± 0.05	0.21	5	=	
2215	1	16	2.2 ± 0.1	1572 ± 72	1.71 ± 0.03	0.95 ± 0.01	0.94 ± 0.01	0.042 ± 0.003	4.00 ± 0.25	0.99	0.02	H15 mean	16	3.78 ± 0.10	0.39	6	>	
2216	1	16	2.6 ± 0.1	2532 ± 124	1.37 ± 0.02	0.99 ± 0.01	1.00 ± 0.01	0.015 ± 0.001	4.68 ± 0.14	0.58	0.01	H15 mean	16	4.67 ± 0.16	0.63	15	>	
2217	1	16	4.3 ± 0.3	2431 ± 157	1.31 ± 0.04	0.99 ± 0.01	0.98 ± 0.01	0.023 ± 0.001	15.01 ± 0.80	3.21	0.05	H15 mean	16	14.67 ± 0.63	2.54	14	=	
2218	1	15	3.4 ± 0.2	2389 ± 161	1.09 ± 0.02	0.98 ± 0.01	0.98 ± 0.01	0.023 ± 0.001	33.03 ± 2.85	11.03	0.22	H15 mean	15	32.30 ± 2.76	10.70	12	>	
2219	1	16	3.1 ± 0.2	2217 ± 163	1.91 ± 0.05	0.87 ± 0.01	0.86 ± 0.01	0.068 ± 0.004	0.30 ± 0.03	0.13	0.00	H15 mean	16	0.29 ± 0.04	0.14	17		
2220	1	14	3.6 ± 0.1	827 ± 54	1.66 ± 0.06	0.95 ± 0.03	0.89 ± 0.01	0.052 ± 0.003	3.04 ± 0.18	0.68	0.01	H15 mean	14	3.04 ± 0.20	0.77	17		
2221	1	13	3.3 ± 0.2	929 ± 49	1.83 ± 0.05	0.91 ± 0.01	0.90 ± 0.01	0.055 ± 0.003	1.91 ± 0.06	0.23	0.01	H15 mean	13	1.91 ± 0.07	0.25	10	=	
2222	1	16	2.7 ± 0.2	1539 ± 85	1.40 ± 0.03	1.00 ± 0.01	0.99 ± 0.01	0.021 ± 0.001	7.38 ± 0.34	1.37	0.02	H15 mean	16	7.29 ± 0.30	1.21	14	=	
2223	1	16	2.7 ± 0.1	1938 ± 153	1.74 ± 0.02	0.96 ± 0.01	0.96 ± 0.01	0.039 ± 0.002	5.96 ± 0.30	1.22	0.01	H15 mean	16	5.80 ± 0.24	0.95	20	>	
2224	1	16	2.3 ± 0.1	1626 ± 138	1.71 ± 0.03	0.95 ± 0.01	0.94 ± 0.01	0.042 ± 0.003	5.10 ± 0.16	0.63	0.01	H15 mean	16	5.05 ± 0.15	0.61	14	=	
2226	1	16	1.7 ± 0.3	990 ± 2274	1.37 ± 0.02	0.99 ± 0.01	1.00 ± 0.01	0.015 ± 0.001	5.27 ± 0.45	1.79	0.02	H15 mean	16	4.89 ± 0.26	1.06	17	>	
2227	1	16	3.2 ± 0.2	1039 ± 56	1.54 ± 0.05	1.05 ± 0.03	1.05 ± 0.03	0.043 ± 0.003	5.86 ± 0.35	1.40	0.02	H15 mean	16	5.82 ± 0.36	1.43	18		

a. Values = arithmetic means. Errors = σ/N$^{1/2}$, σ = standard deviation, N = number of aliquots

b. Errors incorporate additional 2% source calibration uncertainty

c. pe = propagated error. Propagated through the calculation of the mean from measurement uncertainties for each aliquot

d. Robust Mean: H15 mean (and σ) calculated iteratively by reducing the weight of data outwith 1.5 σ (RSC, 2001)

e. =/</>: Robust Mean De appears to be representative/an underestimate/an overestimate

5.3. Age estimates

Listed in Table 5.5 are the sums of the effective beta, gamma and cosmic dose rates and the "H15 Robust Mean" central equivalent dose estimates. Age values were calculated as equivalent dose divided by dose rate, and converted to calendar dates.

30 sets of dose rates, and 26 equivalent doses, and hence 26 OSL ages were determined. Dose rate ranges from 1.1 to 5.0 mGy/a; the average is 2.6 mGy/a ± 0.8. De values range from 0.29 to 33 Gy; the average is 6.6 Gy ± 6.7. Age estimates for these samples range from 0.14 to 13 ka, with an average of 2.9 ka ± 3.1. Uncertainties on the age estimates are quoted at 1se. The age uncertainties range from 0.02 to 1.1 ka, the average is 0.2 ka ± 0.2. These values equate to 3 to 12 % uncertainty, with an average of 7 % ± 2.

Table 5.5. Dose rates, equivalent doses, ages and calendar dates

Sample Number		Total Dose Rate	Equivalent Dose	Age	%	Calendar Date[b]	Notes[c]	
SUERC	Field	(mGy/a)	(Gy)	(ka)[a]	error	AD/BC	De	DR
SUTL 2090	C009 B1	2.53 ± 0.11	not measured					
SUTL 2091	C009 B2	2.29 ± 0.06	3.81 ± 0.09	1.66 ± 0.06	4	340 AD ± 60	=	
SUTL 2092	C009 T1	2.54 ± 0.09	not measured					
SUTL 2093	C009 T2	2.95 ± 0.20	2.37 ± 0.06	0.80 ± 0.06	7	1200 AD ± 60	=	=
SUTL 2094	C018 1	3.56 ± 0.12	1.26 ± 0.06	0.35 ± 0.02	6	1650 AD ± 20	>	=
SUTL 2095	C018 2	3.13 ± 0.10	2.76 ± 0.10	0.88 ± 0.04	5	1120 AD ± 40	>	
SUTL 2096	E400 1	2.30 ± 0.09	not measured					
SUTL 2097	E400 2	2.44 ± 0.09	5.92 ± 0.21	2.43 ± 0.12	5	400 BC ± 100	=	=
SUTL 2098	E400 3	2.11 ± 0.16	7.66 ± 0.18	3.62 ± 0.28	8	1600 BC ± 300	=	=
SUTL 2099	F101	1.60 ± 0.06	1.64 ± 0.07	1.02 ± 0.06	6	980 AD ± 60	=	
SUTL 2100	F102 1	2.25 ± 0.08	not measured					
SUTL 2101	F102 2	1.84 ± 0.07	13.88 ± 0.53	7.56 ± 0.41	5	5600 BC ± 400		
SUTL 2102	Z021 1	1.86 ± 0.03	12.18 ± 0.68	6.56 ± 0.38	6	4600 BC ± 400		
SUTL 2103	Z021 2	1.43 ± 0.08	9.05 ± 0.60	6.32 ± 0.55	9	4300 BC ± 500		
SUTL 2104	Z021 3	1.93 ± 0.05	10.84 ± 0.39	5.60 ± 0.25	4	3600 BC ± 200	=	=
SUTL 2105	Z021 4	1.77 ± 0.07	10.23 ± 0.36	5.78 ± 0.29	5	3800 BC ± 300	=	
SUTL 2106	Z021 T	1.07 ± 0.05	0.98 ± 0.07	0.92 ± 0.07	8	1100 AD ± 70	>	
SUTL 2214	F517 1	3.46 ± 0.21	3.59 ± 0.05	1.04 ± 0.06	6	970 AD ± 60	=	
SUTL 2215	F517 2	2.89 ± 0.09	3.78 ± 0.10	1.31 ± 0.05	4	700 AD ± 50	>	
SUTL 2216	D339 1	4.95 ± 0.39	4.67 ± 0.16	0.94 ± 0.08	9	1060 AD ± 80	>	=
SUTL 2217	D339 2	3.52 ± 0.39	14.67 ± 0.63	4.16 ± 0.50	12	2200 BC ± 500	=	=
SUTL 2218	D339 3	2.45 ± 0.10	32.30 ± 2.76	13.2 ± 1.1	9	11000 BC ± 1000	>	
SUTL 2219	C112 1	2.07 ± 0.07	0.29 ± 0.04	0.14 ± 0.02	12	1860 AD ± 20		
SUTL 2220	C112 2	1.74 ± 0.12	3.04 ± 0.20	1.75 ± 0.17	10	300 AD ± 200		
SUTL 2221	C112 3	2.08 ± 0.09	1.91 ± 0.07	0.92 ± 0.05	6	1090 AD ± 50	=	
SUTL 2222	Z021a 1	3.31 ± 0.12	7.29 ± 0.30	2.20 ± 0.12	6	200 BC ± 100	=	
SUTL 2223	Z021a 2	3.44 ± 0.10	5.80 ± 0.24	1.68 ± 0.09	5	320 AD ± 90	>	
SUTL 2224	Z021a 2a	3.57 ± 0.12	5.05 ± 0.15	1.41 ± 0.06	5	590 AD ± 60	=	=
SUTL 2225	Z021a 2b	not measured	not measured					
SUTL 2226	Z021a 3	3.32 ± 0.21	4.89 ± 0.26	1.47 ± 0.12	8	500 AD ± 100	>	
SUTL 2227	Z021a 4	2.85 ± 0.19	5.82 ± 0.36	2.04 ± 0.19	9	0 BC ± 200		=

a. Ages in ka before 2007 AD b. Errors rounded to 1 significant figure, values rounded accordingly
c. =/</>: equivalent dose / dose rate appears to be representative/an underestimate/an overestimate

6. Discussion

6.1. Equivalent dose

The quartz extracts from the Anuradhapura sediments displayed high OSL sensitivity, low IRSL sensitivity, and low zero dose (charge transfer/recuperation) responses (Table 5.4). However, they exhibited a relatively slowly stimulated OSL signal component that was reduced with increasing preheat temperature, such that relative background signal levels differed between regenerative and test measurements, destabilising estimation of De values. To remove much of this signal and eliminate differences between regenerative and test measurements, preheats of 220-280°C/30s were used prior to both (Table 4.1). Recycling ratios of 0.9 to 1.0 were obtained, indicating that the test dose response was adequately monitoring changes in sample sensitivity within the measurement sequence. The evidence of the problematic signal component noted above might be related to the high sensitivity of these samples.

The high luminescence sensitivity of the Anuradhapura samples meant that uncertainties arising from counting statistics in De determination were insignificant compared to other sources of scatter in the data. This indicated that any observed scatter was "genuine", and likely to be largely related to the presence of mixtures of grains with different OSL ages.

Examination of the De distributions for each of the Anuradhapura samples (Appendix D) indicates three basic types:

1/ Samples SUTL 2091, 2101, 2104, 2105, 2216, 2217, 2221 and 2224 have symmetric distributions with low to moderate scatter. The mean and robust mean central estimates for these samples are identical (Table 5.4). These samples were taken from bunds and a "ceramic scatter" sites and a channel (moat) fill.
2/ Samples SUTL 2102, 2103, 2218, 2219, 2220, 2222 and 2227 have roughly symmetric distributions and hence identical arithmetic and robust mean De values, but the distributions contain higher levels of scatter. This may indicate an unresolved mixture of OSL ages in the sediment, such that while the central estimate of De well represents the observed data, this may not produce an archaeologically meaningful age estimate. These samples were taken from bunds, channel (moat) fill, a gravel platform below a "ceramic scatter" site, and a palaeolandsurface substrate.
3/ Samples SUTL 2093, 2094, 2095, 2097, 2098, 2099, 2106, 2214, 2215, 2223 and 2226 have asymmetric distributions with a single main grouping and scatter to higher values. The robust mean central estimates are lower than the arithmetic means for these samples but sometimes still appear to slightly overestimate the main grouping in the distributions, such that the modal value of the data is considered likely to lie at the lower limit of the allowed uncertainties (Table 5.4). This pattern indicates that the samples contain a small proportion of mineral grains with residual luminescence signals. These samples were from bund, tank and channel infill, and buried land-surface contexts.

6.2. Dose rate

Three methods were used for dose rate determination in the present study: field gamma spectrometry, high resolution gamma spectrometry, and thick source beta counting. These measure dose rate from different sizes/geometries of sample in different conditions. Comparison between the results therefore provides indications of any effects on dose rate arising from sediment inhomogeneity and/or disequilibrium in the U and Th series. HRGS also facilitates limited examination of radioactive equilibrium within each measurement.

The HGRS data indicate moderately high to very high levels of Thorium relative to Uranium in the Anuradhapura samples (Th/U up to 16.6, compared with 3 in specimen contexts, e.g. Adamiec and Aitken, 1998). Sri Lanka is a major commercial source of Thorium minerals e.g. Monazite, Thorite, which weather from the granite bedrock and are found naturally concentrated in detrital sands (Read, 1971, 333-337). Relatively high (and variable) Thorium concentrations in sediments from this region are thus likely to be linked to the natural redeposition of Thorium minerals. High Th/U ratios are also a potential indicator of Uranium leaching, and examination of the HGRS results from individual radioisotopes in the ^{238}U series indicates that while ^{226}Ra is generally close to equilibrium with the post ^{222}Rn isotopes including ^{210}Pb, ^{234}Th is often significantly low and sometimes significantly high (Table 6.1). This is considered indicative of past Uranium movement in the Anuradhapura sediments, in which case Radium is also likely to have been mobile. However, due to the high Thorium and moderate Potassium contents of these sediments, variation in Uranium concentration has a limited effect on the overall dose rate to the etched 100 μm quartz grains used for luminescence dating. For example, removal of 100% of the measured Uranium concentrations in Table 5.1 changes the overall beta dose rates by 9%, the overall gamma dose rates by 4%, and the age estimates by 7%. This example is considered extreme given that the high relative Thorium concentrations can be explained in terms of regional lithology, and as such any U-series disequilibrium in the Anuradhapura sediments is unlikely to have had a significant effect on the luminescence age estimates.

With respect to sediment inhomogeneity: gamma dose rates from FGS (in situ, ~ 200 kg field of view) were on average 20% lower than those from HRGS (sealed subsample from tube or bulk sediment around tube, ~ 100 g), and beta dose rates from HRGS were on average 15% lower than those from TSBC (unsealed subsample from tube, 20 g: section 5.1). This is indicative of greater relative concentrations of finer more radioactive material (e.g. clays, thorium sands) being detected in the smaller measurement geometries, although relatively low FGS values might also be measured if the probe was not well enclosed within the section, or if sediment water content behind the face of the section was dramatically higher than that sampled and used for water content determinations. It was noted in section 5.1 that for sample SUTL 2218 both the beta dose rate from TSBC and the gamma dose rate from FGS were much higher than the results from HRGS. A subsample from the bulk sediment used for HRGS was therefore measured using TSBC and yielded a significantly lower beta dose rate (1.48mGy/a ± 0.05) than that obtained from the original TSBC sample from the ends of the luminescence sampling tube (1.63mGy/a ± 0.05 mGy/a, Table 5.2). There was also a colour difference between the fine material in the two samples: the

HRGS sample was redder while the original TSBC sample was browner (more similar to the samples from the layers above, which had higher dose rates). The bulk sample used for HGRS was therefore considered to be unrepresentative of the material used for equivalent dose determination, so the dose rate to this sample was calculated using only the FGS and original TSBC results (section 5.1). However, it should be noted that for the dataset as a whole, the 20% lower gamma dose rate from FGS compared to HRGS is equivalent to a difference of 6% in total dose rate, since gamma radiation contributed 30% of the sample's dose rates. Similarly, the 15% higher beta dose rate from TSBC compared to HRGS is equivalent to a difference of 9% in total dose rate, since beta radiation contributed 62% of the sample's dose rates. Combining the results to calculate total dose rate (section 5.1) therefore cancels out much of the difference, and the remainder is subsumed by the assumed range of burial water contents.

Table 6.1. Activity concentrations for the isotopes in the ^{238}U series measured using HRGS

SUTL No.	Activity Concentration (Bq/kg) ^{234}Th	^{226}Ra	^{214}Pb	^{214}Bi	^{210}Pb	Notes[a]
2090	15 ± 3	14 ± 5	19 ± 0.3	17 ± 1.0	24 ± 9	
2091	44 ± 2	14 ± 7	18 ± 0.3	17 ± 0.9	33 ± 11	234-Th
2092	13 ± 4	16 ± 7	19 ± 0.3	18 ± 1.8	25 ± 12	
2093	14 ± 5	24 ± 8	15 ± 0.6	18 ± 1.4	-1 ± -12	
2094	43 ± 25	13 ± 5	17 ± 0.3	18 ± 1.7	8 ± 9	
2095	21 ± 1	17 ± 5	15 ± 0.6	14 ± 1.9	4 ± 9	234-Th
2096	46 ± 7	29 ± 10	12 ± 1.9	11 ± 1.5	29 ± 13	234-Th
2097	17 ± 5	8 ± 6	12 ± 1.2	12 ± 1.3	6 ± 13	
2098	18 ± 5	19 ± 6	12 ± 1.1	12 ± 1.3	21 ± 10	
2099	23 ± 5	16 ± 6	8 ± 0.5	9 ± 1.1	6 ± 12	234-Th
2100	28 ± 12	10 ± 9	19 ± 0.7	16 ± 2.0	13 ± 15	
2101	17 ± 9	4 ± 6	13 ± 0.1	12 ± 1.5	14 ± 10	
2102	17 ± 0.3	5 ± 8	11 ± 2.3	10 ± 1.5	-2 ± -13	234-Th
2103	23 ± 4	11 ± 7	11 ± 1.9	16 ± 2.8	23 ± 13	234-Th
2104	27 ± 7	18 ± 5	16 ± 0.2	15 ± 1.2	5 ± 9	
2105	30 ± 5	23 ± 6	19 ± 0.2	16 ± 0.4	-1 ± -12	234-Th
2106	34 ± 10	11 ± 12	7 ± 0.2	6 ± 2.3	26 ± 16	234-Th
2214	12 ± 3	21 ± 4	22 ± 2.3	23 ± 0.8	24 ± 7	234-Th
2215	-10 ± 12	20 ± 5	20 ± 0.7	20 ± 2.2	26 ± 9	234-Th
2216	26 ± 7	10 ± 8	18 ± 0.6	20 ± 1.5	11 ± 12	
2217	26 ± 8	17 ± 5	16 ± 0.9	14 ± 0.8	14 ± 10	
2218	15 ± 4	8 ± 3	8 ± 0.4	5 ± 0.7	10 ± 6	
2219	18 ± 2	14 ± 5	11 ± 0.2	9 ± 1.6	19 ± 8	234-Th
2220	-15 ± 3	4 ± 4	8 ± 1.7	7 ± 1.7	-6 ± -8	234-Th
2221	-14 ± 10	11 ± 7	10 ± 0.9	12 ± 1.0	31 ± 12	234-Th
2222	-8 ± 5	16 ± 3	17 ± 1.9	17 ± 0.7	17 ± 7	234-Th
2223	1 ± 5	13 ± 5	19 ± 0.8	19 ± 1.5	19 ± 9	234-Th
2224	1 ± 5	13 ± 5	19 ± 0.8	19 ± 1.5	19 ± 9	234-Th
2226	-9 ± 4	12 ± 4	15 ± 2.0	14 ± 0.7	21 ± 9	234-Th
2227	-12 ± 15	3 ± 7	9 ± 1.1	11 ± 2.2	11 ± 11	
Mean	15 ± 3	14 ± 1	15 ± 1	14 ± 1	15 ± 2	

a. Note of values outwith 2 se of the weighted mean across the full series (table 5.1)

6.3. Ages

The OSL ages for the samples from the Anuradhapura hinterland indicate that the sampled features date to between 1860 AD and 11000 BC (Figure 6.1). Tank and channel fills generally date to the 11th and 12th Centuries AD or later, consistent with accumulation post-abandonment of the hydraulic landscape upon the decline of Anuradhapura itself, although sediments at one site appear to have accumulated during the mediaeval period. Bund and palaeosol features all predate the abandonment phase: one palaeosol immediately predates abandonment; two bunds date to the Iron Age height of Anuradhapura, and third dated to the Late Iron Age / Early Mediaeval period. Another bund and palaeosol sequence yielded dates of 3600-4600 BC whereas these features are not expected to predate the Early Iron Age in this region (i.e., c.1000 BC). Ceramic scatter sites also yielded older than expected luminescence ages, although a layer sealing one site date to the regional abandonment phase. The results from each site are discussed in more detail below.

Location C009 consists of a c.1.5 m bund section, and section through a number of fill layers in the associated tank (Figure 3.2), near the large Nachchaduwa tank. Samples from the lower bund and lower fill yielded OSL dates of 340AD±60 and 1200AD±60 respectively. This indicates a date for bund construction that is consistent with initiation of the major Nachchaduwa bund in the area by the ruler Mahasen (277-304 AD. Simpson *et al.*, pers comm.). The associated tank appears to have been cleaned until shortly prior to c. 1200 AD: a date consistent with and decline in associated infrastructure following the abandonment of Anuradhapura as capital.

Location C018 is a section through an infilled channel originally c. 50 cm deep (Figure 3.3), near the large Nachchaduwa tank (early 4th Century AD). Samples from a thin layer of fill at the base of the channel, and fill approximately level with the ancient bank, yielded OSL dates of 1120AD±40 and 1650AD±20 respectively. The channel thus appears not to have been cleaned, or scoured clean by use, after the first half of the 12th Century. Infill could then have accumulated gradually at c. 0.7 mm/yr, or in a major episode in the mid 17th Century. This is well into the colonial era: around the time that the Dutch took control from the Portuguese. This result hints at land destabilisation or purposeful infill prior to restoration of the irrigation systems in the area from the 18th Century (Simpson *et al.*, pers comm.): could this represent early restorative work under Dutch control?

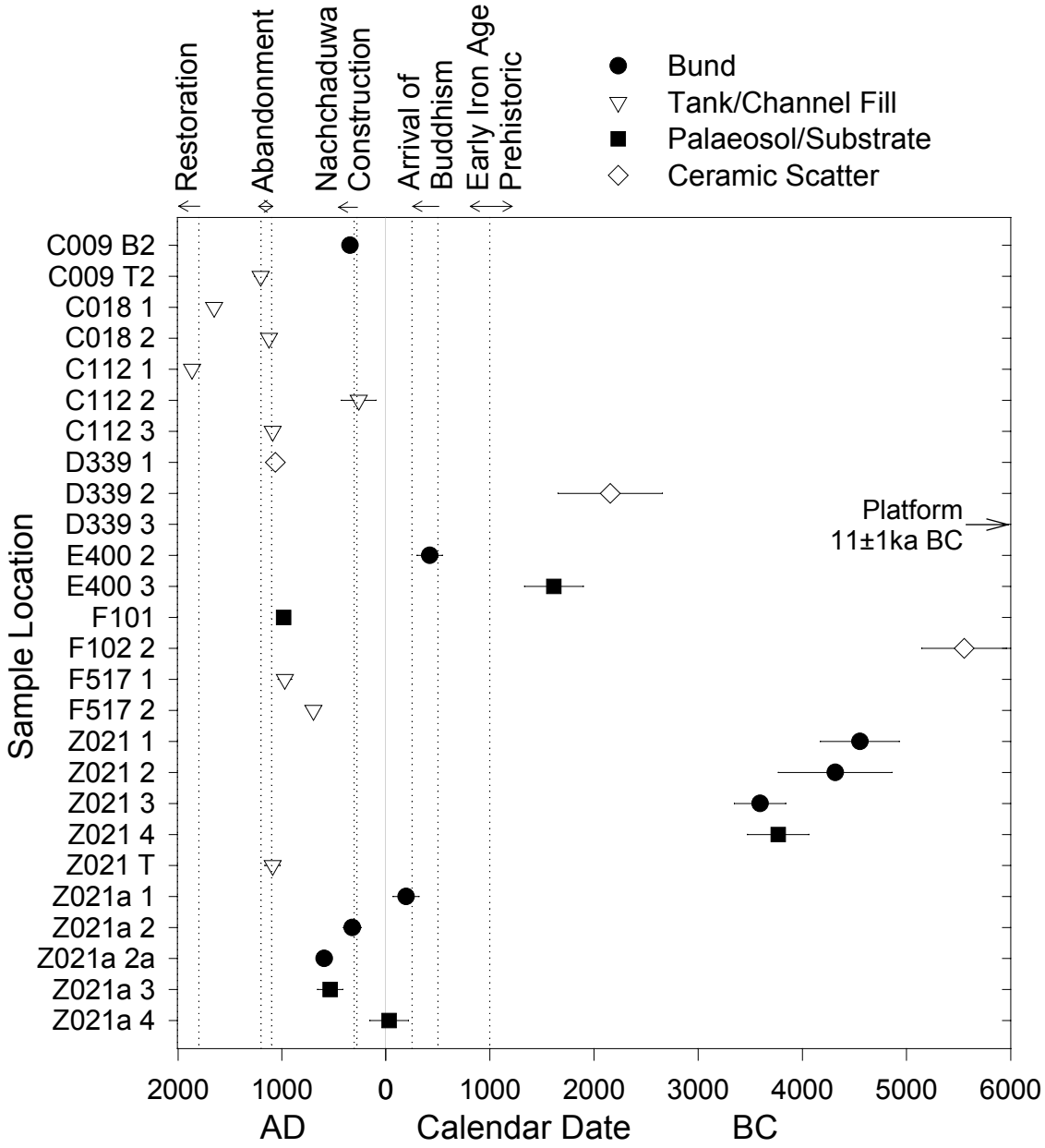
Location C112 is a section through an infilled moat adjacent to a substantial brick structure (Figure 3.9), which is part of a "double platform" monastic site of a type generally thought to have been occupied in the 8th to 10th Centuries AD (Coningham et al., 2007). The moat was originally c. 50 cm deep, and overlying sediments include rubble horizons representing collapse of the adjacent structure. A sample from a thin layer of fill at the base of the moat yielded an OSL date of 1090AD±50. The earliest sediment remaining in the moat thus accumulated after the abandonment of Anuradhapura as capital, but early in or before the period during which the landscape is thought to have been abandoned (12th Century AD). Construction of the adjacent structure could be constrained by luminescence dating of the manufacture of brick or tile debris. The sediment at the base of the moat was sealed by another thin layer, which conformed to the bank of the moat and was rich in sherds of tile, apparently

from roof collapse following abandonment of the structure. A sample from the thicker layer above this, which did not conform to the slope, yielded an OSL date of 300AD±200, and another from a layer further up the section, which sealed the most substantial structural collapse horizon, yielded an OSL date of 1860AD±20. The older date is out of stratigraphic sequence and both these results have relatively high uncertainties as a result of scatter in equivalent dose determinations (section 6.1). In the case of the lower sample such scatter is likely to have been produced by deposition of sediment containing sand grains with a mixture of luminescence ages. This indicates rapid infill of the moat at an undetermined date following initial abandonment. If a similar process produced the scatter in results from the younger sample then this uppermost part of context 012 was probably deposited in the 20th Century. However, sample SUTL 2219 was taken close to the upper bound of the context: if this is a buried land surface then it is likely to have been deposited earlier and reworked by bioturbation through the 19th Century to reset the OSL signal in some of the measured sand grains.

Location D339 is a section through a "ceramic scatter" site founded on an anthropogenically emplaced gravely platform (Figure 3.8). The early Holocene OSL age obtained from the platform (SUTL 2218), combined with substantial scatter in equivalent dose, indicates that this material contains large residual OSL signals and as such the OSL age is not archaeologically relevant. The OSL date from the sediment sealing the platform (SUTL 2217) predates the establishment of Anuradhapura. Given this it is also considered to represent a residual age rather than that of the sediment's accumulation: the sediment may have been redeposited in bulk (i.e. as fill – note alignment and grouping of clasts in Figure 3.8) rather than having accumulated gradually during site useage. However, early occupation might be tested by luminescence analysis of ceramics from within the layer, and the terminus post quem for deposition of this layer may be constrained by ^{14}C dating of samples from the surface of the platform. However, the uppermost sediment layer sampled at site D339 appears to represent a phase of more gradual accumulation conformable with the original ground surface at the site. The OSL sample from this layer yielded a date of 1060AD ± 80, with low scatter in the equivalent dose determinations. This is once again consistent the abandonment of Anuradhapura, but early in or before the period during which the landscape is thought to have been abandoned. Although cultural artefacts were found in this layer it may be that they were redeposited through natural processes (e.g. slope wash) following abandonment of the landscape.

Location E400 is a section through a c. 1.7 m bund and the palaeosol beneath (Figure 3.4), which yielded OSL dates of 400BC±100 and 1600BC±300 respectively. The palaeosol thus dates to the prehistoric period before the establishment of Anuradhapura, while construction of the bund appears to be associated with the early expansion of the settlement into a centre of commerce (Coningham, 2005), prior to the traditional arrival of Buddhism.

Figure 6.1. OSL dating results from bund materials, alluvial fill, buried ground surfaces, and sediment from ceramic scatter horizons in the Anuradhapura hinterland, with *a priori* chronological expectations relating to significant periods in the history of the region and its irrigation systems.



F101 and 102 are sections through ceramic scatter horizons on the flanks of ridges in the Anuradhapura hinterland (Figure 3.5). Samll sites of this type are thought to be associated with slash and burn agriculktural practices, which continued after the demise of Anuradhapura, although site F102 is a relatively large ceramic scatter site for its distance from the citadel of Anuradhapura (Coningham et al., 2007). The sediment containing the ceramic scatter at site F101 was thought to have been reworked: the OSL sample from the palaeosol underlying it yielded a date of 980AD±60, indicating a stable land surface at this time. Reworking probably occurred not long after this, and might therefore be coincident with the sacking of Anuradhapura or the subsequent period of landscape abandonment. At site F102 the sediment containing the ceramic scatter was sampled directly and yielded an OSL

date of 5600BC±400. If correct this date would indicate Neolithic settlement in this area, contemporary with the Early Neolithic of the Indus valley and around 2 millennia before known Neolithic complexes in peninsular India. Sri Lanka has no clear Neolithic, but an extensive microlith scatter ("Mesolithic"?) in the Anuradhapura region has been dated to 3850BC (Coningham, 2005). It is therefore likely that the present OSL result, while intriguing, actually represents residual sediment age. In this case, geomorphological examination of this sediment could help to elucidate the relationship between sediment deposition and the artefacts it contains: if the ceramics were randomly distributed through (and oriented in) the layer then they could have been colluvially mixed into the (old) sediment onto which they were originally deposited, whereas if they formed a "stone line" then it is likely that the sediment was reworked around them by bioturbation, effectively burying them to the depth of the worm activity (Limbrey, 1975; Canti, 2003). Note that such a stone line should be readily distinguishable from the larger scale features produced by colluvial transport of weathered bedrock mentioned in Simpson *et al*. (pers comm.). Colluviated or bioturbated sediment is likely to have had the OSL signal bleached from at least a proportion of its mineral grains by these processes. The sample from F102 (SUTL 2101) exhibited symmetric scatter in equivalent dose, with a central main grouping, but it is still possible that this contained a mixture of components that might be separated using single grain analysis. However, luminescence dates could be obtained directly from the sherds of these ceramic scatter contexts: for small sherds dosmetric uncertainties would limit precision, but would still be sufficient to test the OSL sediment ages.

Location F517 is a section through an infilled channel, originally c. 60 cm deep, and overlying colluvial sediments sealed by building foundations (Figure 3.7). The sample from the initial channel fill dated to 700AD ± 50, and that from the uppermost layer not disturbed by construction activity dated to 970AD ± 60. Both sets of measurements exhibited little scatter in equivalent dose, although the distribution from the older sample was slightly asymmetric such that the date of deposition is likely to lie at the lower end of the allowed uncertainties (i.e. around 750AD). Therefore, in contrast to other channel fills dated in the present study, this channel appears to have been abandoned in the Late Iron Age / Early Mediaeval period, then to have filled rapidly (~4.7 mm/a) up to the period in which Anuradhapura was finally sacked. The building foundations at the site were therefore constructed during or after the decline of Anuradhapura.

Location Z021 consists of a c. 4 m bund section, and c. 1 m section through fill in the associated tank (Figure 3.2). The site is close to a large monastic site (Z00) thought to have been utilised from the mid 8th Century to the 12th Century AD (Coningham et al., 2007), and near the large Nachchaduwa tank (early 4th Century AD). The sample from the tank fill dated to 1100AD±70, i.e. again consistent with the abandonment of Anuradhapura hinterland. The upper layers of this substantial bund were thought to have lost sediment structure due to bioturbation, so only the lower half was sampled for luminescence dating. The lowest bund layer and the palaeo-landsurface under it yielded similar OSL ages, consistent with c.3700 BC, while the two samples from further up the bund yielded older results, consistent with c. 4500 BC. Taken at face value the OSL results indicate a massive construction dating to c. 3700 BC, so the same arguments with respect to archaeological context apply as to sample SUTL

2101, above. It is interesting to note the similarity in age to the extensive microlith scatter identified c. 20 km to the North. The luminescence behaviour and dosimetry of the samples from the Z021 bund (SUTL 2102-2105) did not appear anomalous, but the De distributions were similarly scattered and symmetric to SUTL 2101 and the sedimentary context of the site again indicates an explanation based on residual OSL sediment age. Z021 is a large bund, perhaps too large to have been constructed from recently deposited sediment. Its construction is likely to have required the excavation of old subsoil, which in this region is likely to have been colluvium. The ages obtained from Z021 are greater even than existing indications of Holocene colluviation in the region (Colluvial episode ~2.8ka, preceded by a Pleistocene episode ~28ka: Deraniyagala, 1992, in Simpson *et al*., pers comm.), but note that the precise 10:1 ratio in the quoted ages for these colluvial episodes could indicate a degree of interpretative approximation in the values: it may be that colluvial episodes occurred throughout the Holocene.

Location Z021a consists of a c. 1.6 m section through a bund and into the buried land surface beneath. This smaller bund was a subsidiary part of the same water management system as that at Z021. Again, the lowermost samples from the bund and the uppermost sample from the palaeosol yielded broadly similar OSL ages (SUTL 2223: 320AD±90, SUTL 2224: 590AD±60, SUTL 2226: 500AD±100), which were lower than those from the samples above and below them (SUTL 2222: 200BC±100, SUTL 2227: 0BC±200). It is interesting to note the difference in OSL age between samples SUTL 2223 and 2224, taken in close proximity to each other from the base of the bund: this indicates the spatial variability in resetting of the OSL signal that can be observed in this type of sediment. Although the texture of the sediments differed, the similarity of the OSL age estimates from higher in the bund and lower in the substrate indicates that the lowest part of the bund was made from topsoil, with substrate being added on top as more material was excavated. Of the younger age estimates, samples SUTL 2223 and 2226 yielded equivalent dose distributions with some scatter to high values, whereas that of SUTL 2224 had lower scatter and was more symmetrical. The Z021a bund is therefore most likely to have been constructed late in the 6th or early in the 7th century AD. The Z021 bund was probably constructed prior to this, which would be consistent with development of irrigation systems in the area after construction of the large Nachchaduwa tank nearby (from the early 4th Century AD), but indicates that these systems were in place before development of the nearby Monastic complex (Z00) is expected to have occurred.

The utility of OSL results from reservoir and channel fill deposits for examining abandonment in the present study concurs with the findings of Bishop *et al.* (2004), and contrasts with the conclusions of Shaw *et al.* (2007). Bishop *et al.* (2004) examined an irrigation system established during a period of urbanisation and abandoned when a seat of power moved, in their case associated with Angkor Borei in Cambodia: they constrained abandonment of the canal to the fifth – sixth centuries AD. Shaw *et al.* (2007) examined a water management system that was both more similar and geographically closer to that in the present study (Sanchi, Central India). The results they considered more reliable ranged from c. 210 AD to c. 3680 BC and included potsherds apparently of Neolithic age: *c.f.* the c. 3700 BC dates from Z021 and for the microlith scatter near Anuradhapura. Shaw *et al.* (2007) concluded that Chalcolithic material had been re-utilised in the construction of the irrigation systems.

They considered their results from “predam” and “reservoir” samples less reliable: one was very old (>9ka BP), and the youngest extended only into the Late Iron Age. This could indicate much earlier abandonment of the irrigation systems in the Sanchi area than around Anuradhapura.

7. Conclusions

The present study supports a new investigation into the development and decline of irrigation and associated human activity in the Anuradhapura Hinterland, Sri Lanka. It has investigated the potential of sediments from a variety of landscape contexts in the Anuradhapura hinterland to yield geomorphologically and hence archaeologically meaningful OSL age estimates. It has thus helped constrain the dates of construction, usage and abandonment of these contexts, and integrated the OSL results with independent archaeological and historical expectations.

The period most commonly represented by sedimentary accumulations in the present study is that of the abandonment of Anuradhapura: maintenance of infrastructure in the hinterland appears to have declined shortly after Anuradhapura was sacked (and the capital moved), and the agricultural landscape appears to have been in decline prior to the exodus of the Sinhalese from the region. Many of the features dating to the abandonment period are channel and tank fills, although colluvium and a palaeosol were also identified. These features appear be the result of relaxation of the sedimentary system following the abandonment of intensive agricultural maintenance, in contrast to ancient European agriculture where intensive agricultural phases are positively linked to landscape destabilisation. Some of the initial fills were sealed by thicker layers of reworked material with residual luminescence age. This tends to indicate rapid or bulk redeposition, such that the mineral grains in the sediment were not exposed to light during transport, and so their OSL signals were not reset. Bulk redeposition may indicate deliberate infilling, at present constrained to lie between the abandonment of the Anuradhapura landscape and the partial restoration of irrigation systems in the 18th Century.

Three of the four sampled bund structures yielded OSL dates from the period of Anuradhapura's dominance in the region. One dated to the Anuradhapura's initial period of urbanisation, and was underlain by a palaeosol predating the settlement's establishment. A second dated to the documented Late Iron Age period of the major Nachchaduwa bund construction. The construction of a third dated to the Late Iron Age / Early Mediaeval height of Anuradhapura. The fourth and largest bund, the palaeosol underlying it, and ceramic scatter horizons from other locations, yielded OSL dates older than 2000 BC. Some though not all yielded indications of incomplete resetting of the OSL signal or mixing. Given the lack of known Chalcolithic and Neolithic archaeology in Sri Lanka it is likely that these dates are a consequence of the redeposition of old material en masse. However, the possibility of remains from this period in Sri Lanka may make further investigation desirable. This could be pursued through more intensive geochronological studies of the bund-tank systems, and luminescence analysis of the sherds, tiles, and bricks themselves from occupied sites.

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Appendix A. Luminescence sampling forms (by Ian Simpson)

Site Code: C009 **Site Name:**	**Date:** **August 2006**	**Context No: 2**	**Luminescence** **Sample No: 1**
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments in upper part of dam bund			
Nature of Dating Problem:			
Age of bund formation			

Completed By	**Checked By**	**Date**

Site Code: C009 - tank Site Name:	Date: August 2006	Context No: 1	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediments accumulated in tank

Nature of Dating Problem:

Age of sediment accumulation

Completed By	Checked By	Date

Site Code: C009 Site Name:	Date: August 2006	Context No: 5	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments in lower part of dam bund			
Nature of Dating Problem:			
Age of bund formation			
Completed By	**Checked By**	**Date**	

Site Code: C009 - tank Site Name:	Date: August 2006	Context No: 3	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediments accumulated in tank

Nature of Dating Problem:

Age of sediment accumulation

Completed By	Checked By	Date

Site Code: C018 - channel Site Name:	Date: August 2006	Context No: 2	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:
In situ gamma spectrometry from 2 inch NaI detector
Description of Sample:
Sediments accumulated in channel – upper sediments
Nature of Dating Problem:
Age of upper sediment accumulation in channel

Completed By	Checked By	Date

Site Code: C018 - channel Site Name:	Date: August 2006	Context No: 5	Luminescence Sample No: 2

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediments accumulated in channel – lower sediments

Nature of Dating Problem:

Age of lower sediment accumulation in channel

Completed By	Checked By	Date

Site Code: E400 - bund Site Name:	Date: August 2006	Context No: 3	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediments in upper part of dam bund

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Site Code: E400 - bund Site Name:	Date: August 2006	Context No: 7	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediments at base of dam bund

Nature of Dating Problem:

Onset of bund formation

Completed By	Checked By	Date

Site Code: E400 - bund Site Name:	Date: August 2006	Context No: 8	Luminescence Sample No: 3
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Fossil soil beneath dam bund

Nature of Dating Problem:

Age of fossil soil / onset of bund formation

Completed By	Checked By	Date

Site Code: F101 Site Name:	Date: August 2006	Context No: 5	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector.			
Description of Sample:			
Fossil soil located beneath cultural overburden, Anuradhapura hinterland, Sri Lanka.			
Nature of Dating Problem:			
Age of fossil soil / onset of cultural accumuation			
Completed By	**Checked By**	**Date**	

Site Code: F102 Site Name:	Date: August 2006	Context No: 3	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Ceramic scatter located beneath overburden, Anuradhapura hinterland, Sri Lanka.			
Nature of Dating Problem:			
Age of ceramic scatter horizon – upper part of horizon			
Completed By	**Checked By**	**Date**	

Site Code: F102 Site Name:	Date: August 2006	Context No: 3	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Ceramic scatter located beneath overburden, Anuradhapura hinterland, Sri Lanka.			
Nature of Dating Problem:			
Age of ceramic scatter horizon – lower part of horizon			
Completed By	**Checked By**	**Date**	

Site Code: Z021 - bund Site Name:	Date: August 2006	Context No: 4	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments associated with bund formation			
Nature of Dating Problem:			
Age of sediments associated with bund formation			
Completed By	**Checked By**	**Date**	

Site Code: Z021 - tank Site Name:	Date: August 2006	Context No: 2	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:
In situ gamma spectrometry from 2 inch NaI detector
Description of Sample:
Sediments accumulated in tank
Nature of Dating Problem:
Age of sediments accumulated in tank

Completed By	Checked By	Date

Site Code: Z021 - bund Site Name:	Date: August 2006	Context No: 5	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments associated with bund formation			
Nature of Dating Problem:			
Age of sediments associated with bund formation			
Completed By	**Checked By**	**Date**	

Site Code: Z021 - bund Site Name:	Date: August 2006	Context No: 7	Luminescence Sample No: 3
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments associated with lower bund formation			
Nature of Dating Problem:			
Age of sediments associated with lower bund formation			
Completed By	**Checked By**	**Date**	

Site Code: Z021 - bund Site Name:	Date: August 2006	Context No: 9	Luminescence Sample No: 4
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediments associated with lower bund formation / fossil soil			
Nature of Dating Problem:			
Age of sediments associated with lower bund formation / fossil soil			
Completed By	**Checked By**	**Date**	

Site Code: C112 Site Name:	Date: August 2007	Context No: 012	Luminescence Sample No: 1
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Sediment accumulation, post site abandonment

Nature of Dating Problem:

Age of sediment – age of site abandonment

Completed By	Checked By	Date

Site Code: C112 Site Name:	Date: August 2007	Context No: 012A	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediment accumulation, post site abandonment (seasonally wet; dry at time of collection)			
Nature of Dating Problem:			
Age of sediment – age of site abandonment			

Completed By	Checked By	Date

Site Code: C112 Site Name:	Date: August 2007	Context No: 013A	Luminescence Sample No: 3
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Sediment accumulation in moat (double platform site) prior to site abandonment			
Nature of Dating Problem:			
Age of sediment – age of functioning site			

Completed By	Checked By	Date

Site Code: D339 Site Name:	Date: August 2007	Context No: 203	Luminescence Sample No: 1

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Cultural deposit

Nature of Dating Problem:

Age of cultural deposit

Completed By	Checked By	Date

Site Code: D339 Site Name:	Date: August 2007	Context No: 204	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Cultural deposit (with terra cotta)			
Nature of Dating Problem:			
Age of cultural deposit			

Completed By	Checked By	Date

Site Code: D339 Site Name:	Date: August 2007	Context No: 205	Luminescence Sample No: 3
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	
Gamma Dosimetry	**Reading**	**Assoc. Sample**	**Ref No**
Details:			
In situ gamma spectrometry from 2 inch NaI detector			
Description of Sample:			
Cultural deposit – platform packing material			
Nature of Dating Problem:			
Age of cultural deposit			

Completed By	Checked By	Date

Site Code: F517 Site Name:	Date: August 2007	Context No: 108	Luminescence Sample No: 1

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Anthropogenic sediments – disintegrated brick

Nature of Dating Problem:

Age of anthropogenic sediment

Completed By	Checked By	Date

Site Code: F517 Site Name:	Date: August 2007	Context No: 113	Luminescence Sample No: 2
Description of sampling location :		**Sketch of surrounding area**	
See attached		See attached	
		Photo No:	

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:
In situ gamma spectrometry from 2 inch NaI detector
Description of Sample:
Alluvial deposit underlying archaeological site
Nature of Dating Problem:
Age of alluvial deposit

Completed By	Checked By	Date

Site Code: Z021a Site Name:	Date: August 2007	Context No: 4 (upper)	Luminescence Sample No: 1

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Dam bund sediments

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Site Code: Z021a Site Name:	Date: August 2007	Context No: 4 (lower)	Luminescence Sample No: 2

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Dam bund sediments

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Site Code: Z021a Site Name:	Date: August 2007	Context No: 4 (lower)	Luminescence Sample No: 2B

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Dam bund sediments

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Site Code: Z021a Site Name:	Date: August 2007	Context No: 5 (lower)	Luminescence Sample No: 4

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Buried land surface - soils

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Site Code: Z021a Site Name:	Date: August 2007	Context No: 5 (upper)	Luminescence Sample No: 3

Description of sampling location :	Sketch of surrounding area
See attached	See attached
	Photo No:

Gamma Dosimetry	Reading	Assoc. Sample	Ref No

Details:

In situ gamma spectrometry from 2 inch NaI detector

Description of Sample:

Buried land surface - soils

Nature of Dating Problem:

Age of bund formation

Completed By	Checked By	Date

Appendix B. Sample preparation and measurement

Sample		Subsample Water Content		For OSL Measurements				Retained unprocessed				For HRGS			Date	Date	For Beta Counting		Date
		Sample	Mass	Sample	Mass (g)			Sample	Mass (g)			Sample	Mass	Pot	Gamma	Gamma	Sample	Mass	Bctg
SUTL	Type	From	Dry Sed (g)	From	Pot	S+P	Sed	From	Pot	S+P	Sed	From	(g)	Type	Sealed	Measured	From	(g)	20g
2090	Tube	all, in tube	103	core of tube	20.0	112.3	92.3	tube ends	17.6	27.5	9.9	for meas.	92.3	100g wide	150107	260207	for meas.	20	280207
2091	Tube	all, in tube	88	core of tube	20.1	100.5	80.4	tube ends	18.8	25.9	7.1	for meas.	80.4	100g wide	150107	190207	for meas.	20	280207
2092	Tube	all, in tube	116	core of tube	19.8	127.9	108.1	tube ends	18.0	25.1	7.1	for meas.	100.0	100g wide	150107	260207	for meas.	20	290207
2093	Tube	all, in tube	109	core of tube	20.1	124.0	103.9	tube ends	18.0	23.3	5.3	for meas.	100.0	100g wide	150107	230207	for meas.	20	290207
2094	Tube	all, in tube	138	core of tube	20.2	148.0	127.8	tube ends	18.5	25.7	7.2	for meas.	100.0	100g wide	150107	190207	for meas.	20	290207
2095	Tube	all, in tube	66	core of tube	20.1	81.8	61.7	tube ends	18.6	22.8	4.2	for meas.	50.0	50g	150107	140207	for meas.	20	290207
2096	Tube	all, in tube	39	core of tube	20.0	56.0	36.0	tube ends	18.5	21.4	2.9	for meas.	20.0	20g petri	150107	120207	for meas.	20	202027
2097	Tube	all, in tube	55	core of tube	20.0	69.1	49.1	tube ends	17.6	23.9	6.3	for meas.	49.1	50g	150107	140207	for meas.	20	200307
2098	Tube	all, in tube	51	core of tube	20.3	65.9	45.6	tube ends	18.5	23.8	5.3	for meas.	45.6	50g	150107	150207	for meas.	20	200307
2099	Tube	all, in tube	65	core of tube	20.1	74.1	54.0	tube ends	18.0	28.5	10.5	for meas.	50.0	50g	150107	150207	for meas.	20	202027
2100	Tube	all, in tube	82	core of tube	20.2	95.1	74.9	tube ends	17.7	24.6	6.9	for meas.	74.9	100g wide	150107	230207	for meas.	20	212027
2101	Tube	all, in tube	46	core of tube	20.2	63.2	43.0	tube ends	18.4	20.5	2.1	for meas.	43.0	50g	150107	160207	for meas.	20	210307
2102	Tube	all, in tube	87	core of tube	20.1	102.8	82.7	tube ends	18.1	21.9	3.8	for meas.	82.7	100g wide	150107	220207	for meas.	20	212027
2103	Tube	all, in tube	76	core of tube	20.0	104.4	84.4	tube ends	19.0	31.4	12.4	for meas.	84.4	100g wide	150107	210207	for meas.	20	212027
2104	Tube	all, in tube	93	core of tube	20.0	108.2	88.2	tube ends	18.1	22.4	4.3	for meas.	88.2	100g wide	150107	200207	for meas.	20	200307
2105	Tube	all, in tube	75	core of tube	20.0	90.8	70.8	tube ends	18.6	22.5	3.9	for meas.	50.0	50g	150107	160207	for meas.	20	200307
2106	Tube	all, in tube	17	core of tube	20.2	36.6	16.4	tube ends	17.9	18.7	0.8	for meas.	16.4	20g petri	150107	200207	for meas.	20	200307
2214	Tube	all, in tube	81	core of tube	-	-	60.6	tube ends	-	-	26.9	bulk assoc.	100.0	100g wide	41207	171207	ret unproc.	20	210307
2215	Tube	all, in tube	71	core of tube	-	-	54.1	tube ends	-	-	21.8	bulk assoc.	100.0	100g wide	41207	171207	ret unproc.	20	210307
2216	Tube	all, in tube	81	core of tube	-	-	56.9	tube ends	-	-	26.7	bulk assoc.	100.0	100g wide	41207	181207	ret unproc.	20	212027
2217	Tube	all, in tube	102	core of tube	-	-	82.0	tube ends	-	-	24.6	bulk assoc.	100.0	100g wide	41207	191207	ret unproc.	20	212027
2218	Tube	all, in tube	82	core of tube	-	-	57.4	tube ends	-	-	25.4	bulk assoc.	100.0	100g wide	41207	191207	ret unproc.	16.4	210307
2219	Tube	all, in tube	66	core of tube	-	-	48.7	tube ends	-	-	24.5	bulk assoc.	100.0	100g wide	41207	191207	ret unproc.	20	101207
2220	Tube	all, in tube	88	core of tube	-	-	65.0	tube ends	-	-	22.8	bulk assoc.	100.0	100g wide	41207	201207	ret unproc.	20	101207
2221	Tube	all, in tube	89	core of tube	-	-	63.9	tube ends	-	-	25.1	bulk assoc.	100.0	100g wide	41207	201207	ret unproc.	20	101207
2222	Tube	all, in tube	71	core of tube	-	-	45.7	tube ends	-	-	24.3	bulk assoc.	100.0	100g wide	41207	201207	ret unproc.	20	101207
2223	Tube	all, in tube	50	core of tube	-	-	29.8	tube ends	-	-	20.0	bulk assoc.	100.0	100g wide	41207	201207	ret unproc.	20	101207
2224	Tube	all, in tube	59	core of tube	-	-	37.0	tube ends	-	-	20.0						ret unproc.	20	101207
2225	Tube	all, in tube	71	core of tube	-	-	45.2	tube ends	-	-	24.4						ret unproc.	20	111207
2226	Tube	all, in tube	77	core of tube	-	-	55.1	tube ends	-	-	21.4	bulk assoc.	100.0	100g wide	41207	211207	ret unproc.	20	111207
2227	Tube	all, in tube	86	core of tube	-	-	59.4	tube ends	-	-	24.8	bulk assoc.	100.0	100g wide	41207	211207	ret unproc.	20	111207

Sample	Subsample		Subsample		Lumin subsample Prep.										
	No more prep		For Lumin		Settled and Sieved (microns), Retained mass (g)							90-150 micron			
	Sample	Mass	Sample	Mass	Settled	Rinsed	Wet Sieved					10 min 1M HCl			
SUTL	From	(g)	From	(g)	.~<30	.~>60	date	<90	90-150	150-250	">250"	date			reaction
2090	meas. inc dosim.	45.8	meas. inc dosim.	47	7.56	0	210307	not retained	direct to HCl	2.04	14.98	210307	direct to d sep		n
2091	-	-	meas. inc dosim.	80.4	15.9	32.7	230207	not retained	direct to HCl	8.31	27.9	230207	direct to d sep		n
2092	meas. inc dosim.	57.6	meas. inc dosim.	51	7.22	0	210307	not retained	direct to HCl	7.53	22.84	210307	direct to d sep		n
2093	meas. inc dosim.	63.4	meas. inc dosim.	42	6.75	0	210307	not retained	direct to HCl	5.45	14.3	210307	direct to d sep		n
2094	-	-	meas. inc dosim.	127.8	27.5	0	230207	not retained	direct to HCl	7.9	13.2	230207	direct to d sep		n
2095	-	-	meas. inc dosim.	61.7	10.5	0	230207	not retained	direct to HCl	6.08	15.1	230207	direct to d sep		n
2096	meas. inc dosim.	15.9	meas. inc dosim.	21	3.63	0	210307	not retained	direct to HCl	1.99	6.47	210307	direct to d sep		vw
2097	-	-	meas. inc dosim.	49.1	12.9	0	230207	not retained	direct to HCl	4.84	10.8	230207	direct to d sep		vw
2098	-	-	meas. inc dosim.	45.6	7.56	0	230207	not retained	direct to HCl	4.6	21	230207	direct to d sep		vw
2099	meas. inc dosim.	4	meas. inc dosim.	49	7.14	0	210307	not retained	direct to HCl	8.42	16.45	210307	direct to d sep		n
2100	meas. inc dosim.	31.2	meas. inc dosim.	43	5.53	0	210307	not retained	direct to HCl	8.6	13.86	210307	direct to d sep		n
2101	-	-	meas. inc dosim.	45	4.54	0	210307	not retained	direct to HCl	6.05	13.85	210307	direct to d sep		n
2102	meas. inc dosim.	28.3	meas. inc dosim.	54	15.07	0	210307	not retained	direct to HCl	11.12	11.05	210307	direct to d sep		n
2103	meas. inc dosim.	28.6	meas. inc dosim.	56	12.03	0	210307	not retained	direct to HCl	8.48	17.41	210307	direct to d sep		n
2104	-	-	meas. inc dosim.	88.2	21.2	0	230207	not retained	direct to HCl	10.75	20.2	230207	direct to d sep		n
2105	-	-	meas. inc dosim.	70.8	18.3	17.7	230207	not retained	direct to HCl	3.84	5.3	230207	direct to d sep		n
2106	-	-	meas. inc dosim.	16	4.78	0	210307	not retained	direct to HCl	0.86	0.72	210307	direct to d sep		n
2214	-	-	for meas.	60.6	-	-	201107	not retained	direct to HCl	6.83	23.5	201107	direct to d sep		n
2215	-	-	for meas.	54.1	-	-	201107	not retained	direct to HCl	5.71	21.7	201107	direct to d sep		n
2216	-	-	for meas.	56.9	-	-	201107	not retained	direct to HCl	5.49	26.8	201107	direct to d sep		n
2217	-	-	for meas.	82.0	-	-	201107	not retained	direct to HCl	2.77	46.4	201107	direct to d sep		n
2218	-	-	for meas.	57.4	-	-	201107	not retained	direct to HCl	0.96	29.8	201107	direct to d sep		n
2219	-	-	for meas.	48.7	-	-	201107	not retained	direct to HCl	5.26	20.3	201107	direct to d sep		n
2220	-	-	for meas.	65.0	-	-	231107	not retained	direct to HCl	4.7	41.4	231107	direct to d sep		n
2221	-	-	for meas.	63.9	-	-	231107	not retained	direct to HCl	4.2	39.6	231107	direct to d sep		n
2222	-	-	for meas.	45.7	-	-	231107	not retained	direct to HCl	3.8	15.6	231107	direct to d sep		n
2223	-	-	for meas.	29.8	-	-	231107	not retained	direct to HCl	2.5	11.2	231107	direct to d sep		n
2224	-	-	for meas.	37.0	-	-	231107	not retained	direct to HCl	3.5	12.5	231107	direct to d sep		n
2225	-	-	-	-	-	-	-	-	-	-	-	-	-		-
2226	-	-	for meas.	55.1	-	-	231107	not retained	direct to HCl	4.3	23.4	231107	direct to d sep		n
2227	-	-	for meas.	59.4	-	-	231107	not retained	direct to HCl	3.1	41.4	231107	direct to d sep		n

Sample	Lumin subsample Prep. (contd)				mass (g)	error (g)	2.62-2.74 g/cm3					Disks				Measurement			
	Density separation (g/cm3)			pot	1.105	0.004	40min 40% HF, HCl & Resieve												
	Retained	For D. Sep.		<2.62	2.62-2.74	>2.74		Retained	Split for HF	HF <90	HF>90	Set 1		Set 2		Set 1		Set 2	
SUTL	(g)	(g)	date	(g) inc pot	(g) inc pot	(g) inc pot	date	(g) inc pot	(g) inc pot	(g) inc pot	(g) inc pot	date	No.	date	No	date	file	date	file
2090	6.69	direct to d sep	210307	1.365	direct to HF	1.716	220307	-	direct to HF	1.165	1.224								
2091	5.07	direct to d sep	230207	1.309	direct to HF	1.451	260207	-	direct to HF	1.116	1.344	270207	16	150307	16	270207	stl2r1a	150307	stl2r1d
2092	1.89	direct to d sep	210307	1.267	direct to HF	1.538	220307	-	direct to HF	1.145	1.206								
2093	1.14	direct to d sep	210307	1.298	direct to HF	1.455	220307	-	direct to HF	1.116	1.155	010607	16						
2094	7.88	direct to d sep	230207	1.385	direct to HF	1.594	260207	-	direct to HF	1.117	1.231	270207	16	150307	16	270207	stl2r1a	150307	stl2r1d
2095	4.73	direct to d sep	230207	1.367	direct to HF	1.411	260207	-	direct to HF	1.147	1.266	270207	16			050307	stl2r1b		
2096	0.07	direct to d sep	210307	1.329	direct to HF	1.268	220307	-	direct to HF	1.116	1.19								
2097	4.73	direct to d sep	230207	1.379	direct to HF	1.796	260207	-	direct to HF	1.13	1.385	270207	16			050307	stl2r1b		
2098	1.97	direct to d sep	230207	1.307	direct to HF	1.314	260207	-	direct to HF	1.107	1.238	270207	16			080307	stl3r1c		
2099	1.94	direct to d sep	210307	1.266	direct to HF	1.473	220307	-	direct to HF	-	1.137	010607	16						
2100	2.07	direct to d sep	210307	1.25	direct to HF	1.543	220307	-	direct to HF	1.114	1.139								
2101	1.47	direct to d sep	210307	1.244	direct to HF	1.469	220307	-	direct to HF	1.122	1.153	010607	16						
2102	5.25	direct to d sep	210307	1.233	direct to HF	1.483	220307	-	direct to HF	1.12	1.124	300307	16			020407	stl3r1i		
2103	3.51	direct to d sep	210307	1.293	direct to HF	1.368	220307	-	direct to HF	1.128	1.157	300307	16			020407	stl3r1i		
2104	8.64	direct to d sep	230207	1.28	direct to HF	1.423	260207	-	direct to HF	1.148	1.447	270207	16			080307	stl3r1c		
2105	5.38	direct to d sep	230207	1.277	direct to HF	1.412	260207	-	direct to HF	1.155	1.367	270207	16			080307	stl3r1c		
2106	0	direct to d sep	210307	1.157	direct to HF	1.125	220307	-	direct to HF	1.117	1.117	300307	16			020407	stl3r1i		
2214	3.64	direct to d sep	201107	1.35	direct to HF	1.57	201107	-	direct to HF	1.11	1.24	211107	16			231107	sri1r1a		
2215	3.08	direct to d sep	201107	1.38	direct to HF	1.24	201107	-	direct to HF	1.14	1.28	211107	16			231107	sri1r1a		
2216	3.24	direct to d sep	201107	1.48	direct to HF	1.47	201107	-	direct to HF	1.13	1.27	211107	16			231107	sri1r1a		
2217	1.22	direct to d sep	201107	1.44	direct to HF	1.58	201107	-	direct to HF	1.15	1.38	211107	16			261107	sri2r2a		
2218	0	direct to d sep	201107	1.3	direct to HF	1.22	201107	-	direct to HF	1.12	1.28	211107	16			261107	sri2r2a		
2219	2.09	direct to d sep	201107	1.32	direct to HF	1.23	201107	-	direct to HF	1.14	1.45	211107	16			261107	sri2r2a		
2220	1.8	direct to d sep	231107	1.21	direct to HF	1.41	231107	-	direct to HF	1.13	1.18	261107	16			031207	sri3r1b		
2221	1.6	direct to d sep	231107	1.21	direct to HF	1.98	231107	-	direct to HF	1.12	1.18	261107	16			031207	sri3r1b		
2222	3	direct to d sep	231107	1.27	direct to HF	1.48	231107	-	direct to HF	1.13	1.15	261107	16			031207	sri3r1b		
2223	1.2	direct to d sep	231107	1.22	direct to HF	1.61	231107	-	direct to HF	1.12	1.17	031207	16			031207	sri4r2b		
2224	2.1	direct to d sep	231107	1.26	direct to HF	1.86	231107	-	direct to HF	1.11	1.16	031207	16			031207	sri4r2b		
2225	-	-	-	-	-	-	-	-	-	-	-	-	-						
2226	3.4	direct to d sep	231107	1.29	direct to HF	1.76	231107	-	direct to HF	1.11	1.15	031207	16			031207	sri4r2b		
2227	1.8	direct to d sep	231107	1.25	direct to HF	1.28	231107	-	direct to HF	1.12	1.21	031207	16			071207	sri5r1c		

Appendix C. Dosimetry
C.1. Thick source beta counting

Run	933	File	200207		Date	200207		
HV	6.60				Threshold	0.45		
Sample	2094				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.424 .+/- 0.056		3.437 .+/-		0.028			
Background (cps)	0.759 .+/- 0.015		0.742 .+/-		0.004			
Sensitivity (mGy/a/cps)			2.317 .+/-		0.034			
Sample	counts	1140	1217	1234	1225	1219	1194	
	time	600	600	600	600	600	600	
	cps	1.900	2.028	2.057	2.042	2.032	1.990	
Mean gross rate (cps)	2.008 .+/- 0.023		(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		FALSE	2.028	2.057	2.042	2.032	1.990	
Mean gross rate (cps)	2.030 .+/- 0.011		(SD/rtN)	0.026	(poisson error)			
Net rate (cps)	1.287 .+/- 0.026		(poisson error)					
Beta dose rate (Gy/ka)	2.983 .+/- 0.075							

Run	934	File	200207		Date	200207		
HV	6.60				Threshold	0.45		
Sample	2091				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.424 .+/- 0.056		3.437 .+/-		0.028			
Background (cps)	0.759 .+/- 0.015		0.742 .+/-		0.004			
Sensitivity (mGy/a/cps)			2.317 .+/-		0.034			
Sample	counts	888	955	994	923	923	884	
	time	600	600	600	600	600	600	
	cps	1.480	1.592	1.657	1.538	1.538	1.473	
Mean gross rate (cps)	1.546 .+/- 0.028		(SD/rtN)	0.021	(poisson error)			
cps (false if value > 3SD different from mean)		1.480	1.592	1.657	1.538	1.538	1.473	
Mean gross rate (cps)	1.546 .+/- 0.028		(SD/rtN)	0.021	(poisson error)			
Net rate (cps)	0.804 .+/- 0.021		(poisson error)					
Beta dose rate (Gy/ka)	1.863 .+/- 0.056							

Run	935	File	210207		Date	210207		
HV	6.60				Threshold	0.45		
Sample	2097				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.478	.+/- 0.054	3.446	.+/-	0.025			
Background (cps)	0.763	.+/- 0.015	0.744	.+/-	0.004			
Sensitivity (mGy/a/cps)			2.311	.+/-	0.032			
Sample	counts	1038	1078	1011	1018	1047	967	
	time	600	600	600	600	600	600	
	cps	1.730	1.797	1.685	1.697	1.745	1.612	
Mean gross rate (cps)	1.711	.+/- 0.026	(SD/rtN)	0.022	(poisson error)			
cps (false if value > 3SD different from mean)		1.730	1.797	1.685	1.697	1.745	1.612	
Mean gross rate (cps)	1.711	.+/- 0.026	(SD/rtN)	0.022	(poisson error)			
Net rate (cps)	0.967	.+/- 0.022	(poisson error)					
Beta dose rate (Gy/ka)	2.235	.+/- 0.060						

Run	936	File	210207		Date	210207		
HV	6.60				Threshold	0.45		
Sample	2105				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.478	.+/- 0.054	3.446	.+/-	0.025			
Background (cps)	0.763	.+/- 0.015	0.744	.+/-	0.004			
Sensitivity (mGy/a/cps)			2.311	.+/-	0.032			
Sample	counts	820	833	848	847	807	889	
	time	600	600	600	600	600	600	
	cps	1.367	1.388	1.413	1.412	1.345	1.482	
Mean gross rate (cps)	1.401	.+/- 0.019	(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.367	1.388	1.413	1.412	1.345	1.482	
Mean gross rate (cps)	1.401	.+/- 0.019	(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.658	.+/- 0.020	(poisson error)					
Beta dose rate (Gy/ka)	1.520	.+/- 0.051						

Run	937	File	210207		Date	210207		
HV	6.60				Threshold	0.45		
Sample	2095				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.478	.+/- 0.054	3.446	.+/-	0.025			
Background (cps)	0.763	.+/- 0.015	0.744	.+/-	0.004			
Sensitivity (mGy/a/cps)			2.311	.+/-	0.032			
Sample	counts	1152	1158	1210	1165	1167	1144	
	time	600	600	600	600	600	600	
	cps	1.920	1.930	2.017	1.942	1.945	1.907	
Mean gross rate (cps)	1.943	.+/- 0.016	(SD/rtN)	0.023	(poisson error)			
cps (false if value > 3SD different from mean)		1.920	1.930	FALSE	1.942	1.945	1.907	
Mean gross rate (cps)	1.929	.+/- 0.007	(SD/rtN)	0.025	(poisson error)			
Net rate (cps)	1.185	.+/- 0.026	(poisson error)					
Beta dose rate (Gy/ka)	2.739	.+/- 0.070						

Run	938	File	210207		Date	210207		
HV	6.60				Threshold	0.45		
Sample	2098				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.478	.+/- 0.054	3.446	.+/-	0.025			
Background (cps)	0.763	.+/- 0.015	0.744	.+/-	0.004			
Sensitivity (mGy/a/cps)			2.311	.+/-	0.032			
Sample	counts	939	998	993	983	920	1009	
	time	600	600	600	600	600	600	
	cps	1.565	1.663	1.655	1.638	1.533	1.682	
Mean gross rate (cps)	1.623	.+/- 0.024	(SD/rtN)	0.021	(poisson error)			
cps (false if value > 3SD different from mean)		1.565	1.663	1.655	1.638	1.533	1.682	
Mean gross rate (cps)	1.623	.+/- 0.024	(SD/rtN)	0.021	(poisson error)			
Net rate (cps)	0.879	.+/- 0.022	(poisson error)					
Beta dose rate (Gy/ka)	2.032	.+/- 0.057						

Run	939	File	210207		Date	210207		
HV	6.60				Threshold	0.45		
Sample	2104				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.478	.+/- 0.054	3.446	.+/-	0.025			
Background (cps)	0.763	.+/- 0.015	0.744	.+/-	0.004			
Sensitivity (mGy/a/cps)			2.311	.+/-	0.032			
Sample	counts	859	841	894	807	836	836	
	time	600	600	600	600	600	600	
	cps	1.432	1.402	1.490	1.345	1.393	1.393	
Mean gross rate (cps)	1.409	.+/- 0.020	(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.432	1.402	1.490	1.345	1.393	1.393	
Mean gross rate (cps)	1.409	.+/- 0.020	(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.666	.+/- 0.020	(poisson error)					
Beta dose rate (Gy/ka)	1.538	.+/- 0.051						

Run	945		File	290207			Date	290207			
HV	6.60						Threshold	0.45			
Sample	2090						Mass (g)	20			
	Observed			Rolling Average							
Standard (cps)	3.414	.+/-	0.056	3.445	.+/-	0.021					
Background (cps)	0.788	.+/-	0.016	0.749	.+/-	0.004					
Sensitivity (mGy/a/cps)				2.316	.+/-	0.030					
Sample	counts		1030	993	1024	1011	985	1015			
	time		600	600	600	600	600	600			
	cps		1.717	1.655	1.707	1.685	1.642	1.692			
Mean gross rate (cps)	1.683	.+/-	0.012	(SD/rtN)	0.022	(poisson error)					
cps (false if value > 3SD different from mean)			1.717	1.655	1.707	1.685	1.642	1.692			
Mean gross rate (cps)	1.683	.+/-	0.012	(SD/rtN)	0.022	(poisson error)					
Net rate (cps)	0.934	.+/-	0.022	(poisson error)							
Beta dose rate (Gy/ka)	2.163	.+/-	0.058								

Run	946		File	200307			Date	200307			
HV	6.60						Threshold	0.45			
Sample	2092						Mass (g)	20			
	Observed			Rolling Average							
Standard (cps)	3.388	.+/-	0.053	3.437	.+/-	0.020					
Background (cps)	0.786	.+/-	0.015	0.751	.+/-	0.003					
Sensitivity (mGy/a/cps)				2.324	.+/-	0.029					
Sample	counts		1003	969	1009	1005	1026	947			
	time		600	600	600	600	600	600			
	cps		1.672	1.615	1.682	1.675	1.710	1.578			
Mean gross rate (cps)	1.655	.+/-	0.020	(SD/rtN)	0.021	(poisson error)					
cps (false if value > 3SD different from mean)			1.672	1.615	1.682	1.675	1.710	1.578			
Mean gross rate (cps)	1.655	.+/-	0.020	(SD/rtN)	0.021	(poisson error)					
Net rate (cps)	0.905	.+/-	0.022	(poisson error)							
Beta dose rate (Gy/ka)	2.103	.+/-	0.057								

Run	947		File	200307			Date	200307			
HV	6.60						Threshold	0.45			
Sample	2093						Mass (g)	20			
	Observed			Rolling Average							
Standard (cps)	3.388	.+/-	0.053	3.437	.+/-	0.020					
Background (cps)	0.786	.+/-	0.015	0.751	.+/-	0.003					
Sensitivity (mGy/a/cps)				2.324	.+/-	0.029					
Sample	counts		1117	1133	1161	1122	1135	1170			
	time		600	600	600	600	600	600			
	cps		1.862	1.888	1.935	1.870	1.892	1.950			
Mean gross rate (cps)	1.899	.+/-	0.014	(SD/rtN)	0.023	(poisson error)					
cps (false if value > 3SD different from mean)			1.862	1.888	1.935	1.870	1.892	1.950			
Mean gross rate (cps)	1.899	.+/-	0.014	(SD/rtN)	0.023	(poisson error)					
Net rate (cps)	1.149	.+/-	0.023	(poisson error)							
Beta dose rate (Gy/ka)	2.671	.+/-	0.063								

Run	948	File	200307		Date	200307		
HV	6.60				Threshold	0.45		
Sample	2099				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.388	.+/- 0.053	3.437	.+/-	0.020			
Background (cps)	0.786	.+/- 0.015	0.751	.+/-	0.003			
Sensitivity (mGy/a/cps)			2.324	.+/-	0.029			
Sample	counts	793	746	817	836	797	820	
	time	600	600	600	600	600	600	
	cps	1.322	1.243	1.362	1.393	1.328	1.367	
Mean gross rate (cps)	1.336	.+/- 0.021	(SD/rtN)	0.019	(poisson error)			
cps (false if value > 3SD different from mean)		1.322	FALSE	1.362	1.393	1.328	1.367	
Mean gross rate (cps)	1.354	.+/- 0.013	(SD/rtN)	0.021	(poisson error)			
Net rate (cps)	0.604	.+/- 0.022	(poisson error)					
Beta dose rate (Gy/ka)	1.404	.+/- 0.053						

Run	949	File	200307		Date	200307		
HV	6.60				Threshold	0.45		
Sample	2100				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.388	.+/- 0.053	3.437	.+/-	0.020			
Background (cps)	0.786	.+/- 0.015	0.751	.+/-	0.003			
Sensitivity (mGy/a/cps)			2.324	.+/-	0.029			
Sample	counts	899	903	927	916	932	909	
	time	600	600	600	600	600	600	
	cps	1.498	1.505	1.545	1.527	1.553	1.515	
Mean gross rate (cps)	1.524	.+/- 0.009	(SD/rtN)	0.021	(poisson error)			
cps (false if value > 3SD different from mean)		1.498	1.505	1.545	1.527	1.553	1.515	
Mean gross rate (cps)	1.524	.+/- 0.009	(SD/rtN)	0.021	(poisson error)			
Net rate (cps)	0.773	.+/- 0.021	(poisson error)					
Beta dose rate (Gy/ka)	1.798	.+/- 0.053						

Run	950	File	200307		Date	200307		
HV	6.60				Threshold	0.45		
Sample	2101				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.388	.+/- 0.053	3.437	.+/-	0.020			
Background (cps)	0.786	.+/- 0.015	0.751	.+/-	0.003			
Sensitivity (mGy/a/cps)			2.324	.+/-	0.029			
Sample	counts	870	911	903	878	894	876	
	time	600	600	600	600	600	600	
	cps	1.450	1.518	1.505	1.463	1.490	1.460	
Mean gross rate (cps)	1.481	.+/- 0.011	(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.450	1.518	1.505	1.463	1.490	1.460	
Mean gross rate (cps)	1.481	.+/- 0.011	(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.731	.+/- 0.021	(poisson error)					
Beta dose rate (Gy/ka)	1.698	.+/- 0.052						

Run	951		File	210307		Date	210307	
HV	6.60					Threshold	0.45	
Sample	2096					Mass (g)	20	
	Observed			Rolling Average				
Standard (cps)	3.340	.+/-	0.053	3.426	.+/-	0.018		
Background (cps)	0.756	.+/-	0.014	0.751	.+/-	0.003		
Sensitivity (mGy/a/cps)	2.416	.+/-	0.057	2.335	.+/-	0.028		
Sample	counts		56587	941	900	876	939	970
	time		600	600	600	600	600	600
	cps		94.312	1.568	1.500	1.460	1.565	1.617
Mean gross rate (cps)	17.004	.+/-	15.462	(SD/rtN)	0.069	(poisson error)		
cps (false if value > 3SD different from mean)			FALSE	1.568	1.500	1.460	1.565	1.617
Mean gross rate (cps)	1.542	.+/-	0.028	(SD/rtN)	0.023	(poisson error)		
Net rate (cps)	0.791	.+/-	0.023	(poisson error)				
Beta dose rate (Gy/ka)	1.847	.+/-	0.058					

Run	952		File	210307		Date	210307	
HV	6.60					Threshold	0.45	
Sample	2102					Mass (g)	20	
	Observed			Rolling Average				
Standard (cps)	3.340	.+/-	0.053	3.426	.+/-	0.018		
Background (cps)	0.756	.+/-	0.014	0.751	.+/-	0.003		
Sensitivity (mGy/a/cps)	2.416	.+/-	0.057	2.335	.+/-	0.028		
Sample	counts		822	840	841	876	820	825
	time		600	600	600	600	600	600
	cps		1.370	1.400	1.402	1.460	1.367	1.375
Mean gross rate (cps)	1.396	.+/-	0.014	(SD/rtN)	0.020	(poisson error)		
cps (false if value > 3SD different from mean)			1.370	1.400	1.402	FALSE	1.367	1.375
Mean gross rate (cps)	1.383	.+/-	0.008	(SD/rtN)	0.021	(poisson error)		
Net rate (cps)	0.632	.+/-	0.022	(poisson error)				
Beta dose rate (Gy/ka)	1.475	.+/-	0.054					

Run	953		File	210307		Date	210307	
HV	6.60					Threshold	0.45	
Sample	2103					Mass (g)	20	
	Observed			Rolling Average				
Standard (cps)	3.340	.+/-	0.053	3.426	.+/-	0.018		
Background (cps)	0.756	.+/-	0.014	0.751	.+/-	0.003		
Sensitivity (mGy/a/cps)	2.416	.+/-	0.057	2.335	.+/-	0.028		
Sample	counts		772	821	836	776	809	872
	time		600	600	600	600	600	600
	cps		1.287	1.368	1.393	1.293	1.348	1.453
Mean gross rate (cps)	1.357	.+/-	0.026	(SD/rtN)	0.019	(poisson error)		
cps (false if value > 3SD different from mean)			1.287	1.368	1.393	1.293	1.348	1.453
Mean gross rate (cps)	1.357	.+/-	0.026	(SD/rtN)	0.019	(poisson error)		
Net rate (cps)	0.606	.+/-	0.020	(poisson error)				
Beta dose rate (Gy/ka)	1.416	.+/-	0.049					

Run	954		File	210307		Date	210307	
HV	6.60					Threshold	0.45	
Sample	2106					Mass (g)	20	
	Observed			Rolling Average				
Standard (cps)	3.340	.+/-	0.053	3.426	.+/-	0.018		
Background (cps)	0.756	.+/-	0.014	0.751	.+/-	0.003		
Sensitivity (mGy/a/cps)	2.416	.+/-	0.057	2.335	.+/-	0.028		
Sample	counts		722	637	674	663	682	639
	time		600	600	600	600	600	600
	cps		1.203	1.062	1.123	1.105	1.137	1.065
Mean gross rate (cps)	1.116	.+/-	0.021	(SD/rtN)	0.018	(poisson error)		
cps (false if value > 3SD different from mean)			1.203	1.062	1.123	1.105	1.137	1.065
Mean gross rate (cps)	1.116	.+/-	0.021	(SD/rtN)	0.018	(poisson error)		
Net rate (cps)	0.365	.+/-	0.018	(poisson error)				
Beta dose rate (Gy/ka)	0.852	.+/-	0.043					

Run	997	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2214				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1219	1202	1249	1262	1247	1226	
	time	600	600	600	600	600	600	
	cps	2.032	2.003	2.082	2.103	2.078	2.043	
Mean gross rate (cps)	2.057	.+/- 0.015	(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		2.032	2.003	2.082	2.103	2.078	2.043	
Mean gross rate (cps)	2.057	.+/- 0.015	(SD/rtN)	0.024	(poisson error)			
Net rate (cps)	1.310	.+/- 0.024	(poisson error)					
Beta dose rate (Gy/ka)	3.020	.+/- 0.065						

Run	998	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2215				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1106	1078	1092	1111	1015	1060	
	time	600	600	600	600	600	600	
	cps	1.843	1.797	1.820	1.852	1.692	1.767	
Mean gross rate (cps)	1.795	.+/- 0.024	(SD/rtN)	0.022	(poisson error)			
cps (false if value > 3SD different from mean)		1.843	1.797	1.820	1.852	FALSE	1.767	
Mean gross rate (cps)	1.816	.+/- 0.016	(SD/rtN)	0.025	(poisson error)			
Net rate (cps)	1.069	.+/- 0.025	(poisson error)					
Beta dose rate (Gy/ka)	2.464	.+/- 0.063						

Run	999	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2216				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1681	1631	1710	1727	1685	1670	
	time	600	600	600	600	600	600	
	cps	2.802	2.718	2.850	2.878	2.808	2.783	
Mean gross rate (cps)	2.807	.+/- 0.023	(SD/rtN)	0.028	(poisson error)			
cps (false if value > 3SD different from mean)		2.802	2.718	2.850	2.878	2.808	2.783	
Mean gross rate (cps)	2.807	.+/- 0.023	(SD/rtN)	0.028	(poisson error)			
Net rate (cps)	2.060	.+/- 0.028	(poisson error)					
Beta dose rate (Gy/ka)	4.748	.+/- 0.083						

Run	1000	File	101207		Date	101207	
HV	6.60				Threshold	0.45	
Sample	2217				Mass (g)	20	
	Observed		Rolling Average				
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012		
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003		
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025		
Sample	counts	1346	1297	1397	1302	1320	1331
	time	600	600	600	600	600	600
	cps	2.243	2.162	2.328	2.170	2.200	2.218
Mean gross rate (cps)	2.220 .+/- 0.025		(SD/rtN)	0.025	(poisson error)		
cps (false if value > 3SD different from mean)		2.243	2.162	FALSE	2.170	2.200	2.218
Mean gross rate (cps)	2.199 .+/- 0.015		(SD/rtN)	0.027	(poisson error)		
Net rate (cps)	1.452 .+/- 0.027		(poisson error)				
Beta dose rate (Gy/ka)	3.347 .+/- 0.073						

Run	1001	File	101207		Date	101207	
HV	6.60				Threshold	0.45	
Sample	2218				Mass (g)	20	
	Observed		Rolling Average				
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012		
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003		
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025		
Sample	counts	886	838	871	4191	915	845
	time	600	600	600	600	600	600
	cps	1.477	1.397	1.452	6.985	1.525	1.408
Mean gross rate (cps)	2.374 .+/- 0.922		(SD/rtN)	0.026	(poisson error)		
cps (false if value > 3SD different from mean)		1.477	1.397	1.452	FALSE	1.525	1.408
Mean gross rate (cps)	1.452 .+/- 0.023		(SD/rtN)	0.022	(poisson error)		
Net rate (cps)	0.705 .+/- 0.022		(poisson error)				
Beta dose rate (Gy/ka)	1.625 .+/- 0.054						

Run	1002	File	101207		Date	101207	
HV	6.60				Threshold	0.45	
Sample	2219				Mass (g)	20	
	Observed		Rolling Average				
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012		
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003		
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025		
Sample	counts	896	858	870	884	897	892
	time	600	600	600	600	600	600
	cps	1.493	1.430	1.450	1.473	1.495	1.487
Mean gross rate (cps)	1.471 .+/- 0.011		(SD/rtN)	0.020	(poisson error)		
cps (false if value > 3SD different from mean)		1.493	1.430	1.450	1.473	1.495	1.487
Mean gross rate (cps)	1.471 .+/- 0.011		(SD/rtN)	0.020	(poisson error)		
Net rate (cps)	0.725 .+/- 0.020		(poisson error)				
Beta dose rate (Gy/ka)	1.671 .+/- 0.051						

Run	1003	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2220				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012			
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003			
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025			
Sample	counts	831	865	843	824	840	814	
	time	600	600	600	600	600	600	
	cps	1.385	1.442	1.405	1.373	1.400	1.357	
Mean gross rate (cps)	1.394 .+/- 0.012		(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.385	1.442	1.405	1.373	1.400	1.357	
Mean gross rate (cps)	1.394 .+/- 0.012		(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.647 .+/- 0.020		(poisson error)					
Beta dose rate (Gy/ka)	1.491 .+/- 0.049							

Run	1004	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2221				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012			
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003			
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025			
Sample	counts	876	812	837	852	827	823	
	time	600	600	600	600	600	600	
	cps	1.460	1.353	1.395	1.420	1.378	1.372	
Mean gross rate (cps)	1.396 .+/- 0.016		(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.460	1.353	1.395	1.420	1.378	1.372	
Mean gross rate (cps)	1.396 .+/- 0.016		(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.650 .+/- 0.020		(poisson error)					
Beta dose rate (Gy/ka)	1.498 .+/- 0.049							

Run	1005	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2222				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485 .+/- 0.032		3.456 .+/-		0.012			
Background (cps)	0.754 .+/- 0.008		0.747 .+/-		0.003			
Sensitivity (mGy/a/cps)	2.287 .+/- 0.036		2.305 .+/-		0.025			
Sample	counts	1225	1180	1207	1206	1216	1180	
	time	600	600	600	600	600	600	
	cps	2.042	1.967	2.012	2.010	2.027	1.967	
Mean gross rate (cps)	2.004 .+/- 0.013		(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		2.042	1.967	2.012	2.010	2.027	1.967	
Mean gross rate (cps)	2.004 .+/- 0.013		(SD/rtN)	0.024	(poisson error)			
Net rate (cps)	1.257 .+/- 0.024		(poisson error)					
Beta dose rate (Gy/ka)	2.898 .+/- 0.063							

Run	1006	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2223				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1306	1294	1288	1246	1214	1237	
	time	600	600	600	600	600	600	
	cps	2.177	2.157	2.147	2.077	2.023	2.062	
Mean gross rate (cps)	2.107	.+/- 0.025	(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		2.177	2.157	2.147	2.077	2.023	2.062	
Mean gross rate (cps)	2.107	.+/- 0.025	(SD/rtN)	0.024	(poisson error)			
Net rate (cps)	1.360	.+/- 0.024	(poisson error)					
Beta dose rate (Gy/ka)	3.135	.+/- 0.066						

Run	1007	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2224				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1278	1230	1212	1207	1234	1249	
	time	600	600	600	600	600	600	
	cps	2.130	2.050	2.020	2.012	2.057	2.082	
Mean gross rate (cps)	2.058	.+/- 0.018	(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		2.130	2.050	2.020	2.012	2.057	2.082	
Mean gross rate (cps)	2.058	.+/- 0.018	(SD/rtN)	0.024	(poisson error)			
Net rate (cps)	1.312	.+/- 0.024	(poisson error)					
Beta dose rate (Gy/ka)	3.023	.+/- 0.065						

Run	1008	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2226				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1279	1273	1279	1243	1259	1324	
	time	600	600	600	600	600	600	
	cps	2.132	2.122	2.132	2.072	2.098	2.207	
Mean gross rate (cps)	2.127	.+/- 0.019	(SD/rtN)	0.024	(poisson error)			
cps (false if value > 3SD different from mean)		2.132	2.122	2.132	2.072	2.098	FALSE	
Mean gross rate (cps)	2.111	.+/- 0.012	(SD/rtN)	0.027	(poisson error)			
Net rate (cps)	1.364	.+/- 0.027	(poisson error)					
Beta dose rate (Gy/ka)	3.145	.+/- 0.071						

Run	1009	File	101207		Date	101207		
HV	6.60				Threshold	0.45		
Sample	2227				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.485	.+/- 0.032	3.456	.+/-	0.012			
Background (cps)	0.754	.+/- 0.008	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.287	.+/- 0.036	2.305	.+/-	0.025			
Sample	counts	1166	1102	1204	1105	1132	1157	
	time	600	600	600	600	600	600	
	cps	1.943	1.837	2.007	1.842	1.887	1.928	
Mean gross rate (cps)	1.907	.+/- 0.027	(SD/rtN)	0.023	(poisson error)			
cps (false if value > 3SD different from mean)		1.943	1.837	2.007	1.842	1.887	1.928	
Mean gross rate (cps)	1.907	.+/- 0.027	(SD/rtN)	0.023	(poisson error)			
Net rate (cps)	1.161	.+/- 0.023	(poisson error)					
Beta dose rate (Gy/ka)	2.675	.+/- 0.061						

Run	1010	File	210108		Date	210108		
HV	6.60				Threshold	0.45		
Sample	2218g				Mass (g)	20		
	Observed		Rolling Average					
Standard (cps)	3.464	.+/- 0.054	3.457	.+/-	0.012			
Background (cps)	0.765	.+/- 0.015	0.747	.+/-	0.003			
Sensitivity (mGy/a/cps)	2.314	.+/- 0.053	2.305	.+/-	0.025			
Sample	counts	827	822	818	854	830	857	
	time	600	600	600	600	600	600	
	cps	1.378	1.370	1.363	1.423	1.383	1.428	
Mean gross rate (cps)	1.391	.+/- 0.011	(SD/rtN)	0.020	(poisson error)			
cps (false if value > 3SD different from mean)		1.378	1.370	1.363	1.423	1.383	1.428	
Mean gross rate (cps)	1.391	.+/- 0.011	(SD/rtN)	0.020	(poisson error)			
Net rate (cps)	0.644	.+/- 0.020	(poisson error)					
Beta dose rate (Gy/ka)	1.484	.+/- 0.049						

C.2. High resolution gamma spectrometry

Detector	2															
Sample	**2096**															
Filename	2096															
Roi file	g2oct06.roi															
Date	120207															
Time (ks)	80.00															
Mass (g)	20.0															
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error	Within 2 err of WM ?	WM calcs				
							K		%K							
40-K	1980	53	24.75	0.66	18.45	0.68	563	22	1.82	0.07						
238-U							238U		ppm eU	error		x/sigma^2	1/sigma^	sum		
234-Th	1847	65	23.09	0.81	2.59	0.86	59	20	4.77	1.61	FALSE	0.15	0.00	full	5.96	0.47
	2036	70	25.45	0.88	2.50	0.93	39	15	3.19	1.19	TRUE	0.18	0.00	preRn	0.63	0.02
226-Ra (23	1594	66	19.93	0.83	2.60	0.87	29	10	2.34	0.80	TRUE	0.30	0.01	postRn	5.33	0.46
214-Pb																
	270	34	3.38	0.43	1.83	0.45	17	4	1.40	0.35	TRUE	0.91	0.05			
	544	43	6.80	0.54	2.82	0.57	11	2	0.86	0.18	TRUE	2.21	0.21			
214-Bi	551	45	6.89	0.56	2.65	0.59	11	3	0.92	0.21	TRUE	1.66	0.15			
	137	31	1.71	0.39	0.87	0.41	15	7	1.19	0.57	TRUE	0.30	0.02			
	26	31	0.33	0.39	0.03	0.41	1	22	0.11	1.75	TRUE	0.00	0.00			
	146	26	1.83	0.33	0.12	0.34	3	7	0.21	0.60	TRUE	0.05	0.02			
	64	15	0.80	0.19	0.21	0.20	27	25	2.16	2.01	TRUE	0.04	0.00			
210-Pb	669	60	8.36	0.75	1.75	0.79	29	13	2.34	1.07	TRUE	0.16	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	265	33	3.31	0.41	2.79	0.43	52	9	12.87	2.12	TRUE	0.71	0.01	full	18.51	0.48
	586	48	7.33	0.60	4.97	0.63	38	5	9.42	1.22	TRUE	1.55	0.04			
	528	63	6.60	0.79	3.25	0.83	34	9	8.41	2.18	TRUE	0.44	0.01			
224-Ra																
212-Pb	3417	115	42.71	1.44	33.49	1.51	38	2	9.28	0.44	TRUE	11.83	0.31			
212-Bi	112	35	1.40	0.44	0.74	0.46	20	13	4.94	3.09	TRUE	0.13	0.01			
208-Tl	100	42	1.25	0.53	0.67	0.56	43	37	10.61	9.00	TRUE	0.03	0.00			
	882	52	11.03	0.65	8.02	0.68	45	4	11.06	0.98	TRUE	2.84	0.06			
	84	27	1.05	0.34	0.76	0.36	48	23	11.80	5.72	TRUE	0.09	0.00			
	523	29	6.54	0.36	2.32	0.38	38	7	9.42	1.61	TRUE	0.90	0.02			

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamma	error
Full Series	K	563	22	1.82	0.07			1.51	0.0601	0.43868	0.02
WM	U	12.61	2.115	1.022	0.17	2.84	0.48	0.15	0.025	0.11738	0.02
	Th	38.8	2.096	9.564	0.52	7.07	0.38	0.27	0.0148	0.49161	0.03
					Total	9.91	0.61	1.93	0.0667	1.04767	0.04
Thfull/Ufull				9.36							
Pre 222Rn	U	36.02	57.08	2.917	4.62	8.11	12.85	0.43	0.6754	0.33517	0.53
Post 222Rn	U	11.71	2.197	0.949	0.18	2.64	0.49	0.14	0.026	0.109	0.02
Difference		24.31	57.12	1.97	4.63	5.47	12.86	0.29	0.68	0.23	0.53

Detector	2															
Sample	**2106**															
Filename	2106															
Roi file	g2oct06.roi															
Date	200207															
Time (ks)	80.00															
Mass (g)	16.4				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	1052	43	13.15	0.54	6.85	0.56	255	21	0.82	0.07						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	1685	62	21.06	0.78	0.56	0.82	16	23	1.26	1.85	TRUE	0.03	0.00	full	2.63	0.36
	2020	68	25.25	0.85	2.30	0.90	44	17	3.58	1.42	FALSE	0.14	0.00	preRn	0.26	0.01
226-Ra (23	1450	64	18.13	0.80	0.80	0.85	11	12	0.88	0.93	TRUE	0.08	0.01	postRn	2.37	0.35
214-Pb																
	169	33	2.11	0.41	0.57	0.44	7	5	0.53	0.41	TRUE	0.26	0.04			
	444	40	5.55	0.50	1.57	0.53	7	2	0.58	0.20	TRUE	1.20	0.17			
214-Bi	435	43	5.44	0.54	1.20	0.57	6	3	0.51	0.24	TRUE	0.70	0.11			
	95	29	1.19	0.36	0.34	0.39	7	8	0.57	0.65	TRUE	0.11	0.02			
	34	30	0.43	0.38	0.13	0.40	8	26	0.65	2.07	TRUE	0.01	0.00			
	149	25	1.86	0.31	0.16	0.33	4	9	0.33	0.70	TRUE	0.05	0.01			
	21	14	0.26	0.18	-0.32	0.19	-49	-29	-3.99	-2.33	FALSE	-0.06	0.00			
210-Pb	631	59	7.89	0.74	1.27	0.78	26	16	2.08	1.28	TRUE	0.10	0.00			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	180	30	2.25	0.38	1.73	0.40	39	9	9.72	2.29	FALSE	0.46	0.01	full	4.88	0.41
	253	43	3.16	0.54	0.81	0.57	8	5	1.86	1.31	TRUE	0.27	0.04			
	314	60	3.93	0.75	0.58	0.79	7	10	1.82	2.50	TRUE	0.07	0.01			
224-Ra																
212-Pb	1462	105	18.28	1.31	9.05	1.39	12	2	3.06	0.47	TRUE	3.39	0.27			
212-Bi	48	34	0.60	0.43	-0.06	0.45	-2	-15	-0.46	-3.64	FALSE	-0.01	0.00			
208-Tl	46	40	0.58	0.50	-0.01	0.53	0	-42	-0.10	-10.27	FALSE	0.00	0.00			
	297	46	3.71	0.58	0.71	0.61	5	4	1.19	1.02	TRUE	0.28	0.06			
	55	26	0.69	0.33	0.40	0.34	31	27	7.53	6.56	TRUE	0.04	0.00			
	415	27	5.19	0.34	0.97	0.36	19	7	4.80	1.78	TRUE	0.37	0.02			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	255	21	0.82	0.07			0.68	0.0569	0.199	0.02
WM	U	7.20	2.741	0.583	0.22	1.62	0.62	0.09	0.0324	0.067	0.03
	Th	11.78	2.416	2.903	0.60	2.15	0.44	0.08	0.017	0.149	0.03
					Total	3.77	0.76	0.85	0.0677	0.415	0.04
Thfull/Ufull				4.98							
Pre 222Rn	U	20.16	78.61	1.633	6.37	4.54	17.69	0.24	0.9301	0.188	0.73
Post 222Rn	U	6.73	2.84	0.545	0.23	1.51	0.64	0.08	0.0336	0.063	0.03
Difference		13.44	78.66	1.09	6.37	3.02	17.70	0.16	0.93	0.13	0.73

Detector	2																
Sample	**2095**																
Filename	2095																
Roi file	g2oct06.roi																
Date	140207																
Time (ks)	80.00																
Mass (g)	50				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	4521	73	56.51	0.91	50.21	0.93	763	17	2.47	0.05							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1795	68	22.44	0.85	1.94	0.89	20	9	1.60	0.74	TRUE	0.23	0.01	full	17.19	1.19	
	2034	73	25.43	0.91	2.48	0.96	21	8	1.74	0.68	TRUE	0.30	0.01	preRn	1.13	0.06	
226-Ra (23	1622	69	20.28	0.86	2.95	0.91	17	5	1.39	0.43	TRUE	0.60	0.03	postRn	16.06	1.13	
214-Pb																	
	384	38	4.80	0.48	3.25	0.50	16	3	1.30	0.21	TRUE	2.37	0.15				
	886	49	11.08	0.61	7.10	0.64	14	1	1.14	0.12	TRUE	6.67	0.48				
214-Bi	900	51	11.25	0.64	7.01	0.66	15	2	1.24	0.13	TRUE	5.64	0.37				
	127	35	1.59	0.44	0.74	0.46	7	4	0.56	0.35	TRUE	0.37	0.05				
	150	35	1.88	0.44	1.58	0.46	42	13	3.38	1.02	FALSE	0.26	0.01				
	209	28	2.61	0.35	0.91	0.37	10	4	0.84	0.34	TRUE	0.58	0.06				
	70	16	0.88	0.20	0.29	0.21	16	11	1.26	0.92	TRUE	0.12	0.01				
210-Pb	556	64	6.95	0.80	0.33	0.84	4	9	0.30	0.75	TRUE	0.04	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	341	37	4.26	0.46	3.74	0.48	35	5	8.56	1.14	TRUE	1.62	0.05	full	48.40	1.29	
	991	53	12.39	0.66	10.03	0.69	41	3	10.15	0.73	TRUE	4.67	0.11				
	847	69	10.59	0.86	7.24	0.90	38	5	9.25	1.19	TRUE	1.62	0.04				
224-Ra																	
212-Pb	5382	129	67.28	1.61	58.05	1.68	36	1	8.93	0.28	TRUE	28.08	0.78				
212-Bi	248	39	3.10	0.49	2.44	0.51	38	8	9.40	2.02	TRUE	0.57	0.01				
208-Tl	139	44	1.74	0.55	1.16	0.58	37	19	9.20	4.73	TRUE	0.10	0.00				
	1424	58	17.80	0.73	14.80	0.75	41	2	10.16	0.55	TRUE	8.34	0.20				
	148	29	1.85	0.36	1.56	0.38	48	12	11.77	3.01	TRUE	0.32	0.01				
	725	32	9.06	0.40	4.84	0.42	38	4	9.35	0.87	TRUE	3.08	0.08				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	763	17	2.47	0.05			2.05	0.0444	0.594	0.01
WM	U	14.48	0.842	1.173	0.07	3.26	0.19	0.17	0.01	0.135	0.01
	Th	37.62	0.777	9.273	0.19	6.85	0.14	0.27	0.0055	0.477	0.01
					Total	10.11	0.24	2.48	0.0458	1.206	0.02
Thfull/Ufull				7.91							
Pre 222Rn	U	18.68	16.46	1.512	1.33	4.20	3.70	0.22	0.1947	0.174	0.15
Post 222Rn	U	14.26	0.888	1.155	0.07	3.21	0.20	0.17	0.0105	0.133	0.01
Difference		4.42	16.48	0.36	1.33	0.99	3.71	0.05	0.20	0.04	0.15

Detector	2																
Sample	**2098**																
Filename	2098																
Roi file	g2oct06.roi																
Date	150207																
Time (ks)	80.00																
Mass (g)	45.6				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	2581	59	32.26	0.74	25.96	0.75	432	14	1.40	0.04							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1720	66	21.50	0.83	1.00	0.87	11	10	0.91	0.79	TRUE	0.12	0.01	full	14.33	1.17	
	2042	71	25.53	0.89	2.58	0.94	24	9	1.98	0.73	TRUE	0.30	0.01	preRn	1.01	0.05	
226-Ra (23	1624	66	20.30	0.83	2.98	0.87	19	6	1.54	0.46	TRUE	0.59	0.03	postRn	13.32	1.11	
214-Pb																	
	257	36	3.21	0.45	1.67	0.47	9	3	0.73	0.21	TRUE	1.33	0.15				
	792	46	9.90	0.58	5.92	0.60	13	1	1.04	0.12	TRUE	6.02	0.47				
214-Bi	767	48	9.59	0.60	5.35	0.63	13	2	1.04	0.13	TRUE	4.76	0.37				
	119	32	1.49	0.40	0.64	0.42	7	4	0.53	0.35	TRUE	0.35	0.05				
	101	33	1.26	0.41	0.96	0.43	28	13	2.27	1.04	TRUE	0.17	0.01				
	196	27	2.45	0.34	0.75	0.36	9	5	0.76	0.36	TRUE	0.46	0.05				
	51	15	0.64	0.19	0.05	0.20	3	12	0.24	0.94	TRUE	0.02	0.01				
210-Pb	666	62	8.33	0.78	1.71	0.82	21	10	1.67	0.80	TRUE	0.21	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	332	35	4.15	0.44	3.63	0.46	37	5	9.10	1.19	TRUE	1.58	0.04	full	38.63	1.26	
	830	50	10.38	0.63	8.02	0.65	36	3	8.89	0.75	TRUE	3.90	0.11				
	683	66	8.54	0.83	5.19	0.87	30	5	7.27	1.23	TRUE	1.18	0.04				
224-Ra																	
212-Pb	4201	122	52.51	1.53	43.29	1.59	30	1	7.30	0.28	TRUE	22.49	0.76				
212-Bi	109	36	1.36	0.45	0.71	0.47	12	8	2.98	2.00	FALSE	0.18	0.02				
208-Tl	159	44	1.99	0.55	1.41	0.58	50	21	12.27	5.25	TRUE	0.11	0.00				
	1109	54	13.86	0.68	10.86	0.70	33	2	8.18	0.55	TRUE	6.67	0.20				
	75	28	0.94	0.35	0.65	0.37	22	12	5.36	3.07	TRUE	0.14	0.01				
	612	30	7.65	0.38	3.43	0.39	29	4	7.26	0.87	TRUE	2.38	0.08				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	432	14	1.40	0.04			1.16	0.0362	0.337	0.01
WM	U	12.28	0.856	0.994	0.07	2.76	0.19	0.15	0.0101	0.114	0.01
	Th	30.76	0.796	7.581	0.20	5.60	0.15	0.22	0.0056	0.39	0.01
					Total	8.37	0.24	1.52	0.038	0.841	0.02
Thfull/Ufull				7.63							
Pre 222Rn	U	18.73	18.5	1.517	1.50	4.21	4.16	0.22	0.2189	0.174	0.17
Post 222Rn	U	11.96	0.898	0.969	0.07	2.69	0.20	0.14	0.0106	0.111	0.01
Difference		6.76	18.52	0.55	1.50	1.52	4.17	0.08	0.22	0.06	0.17

Detector	2																
Sample	**2101**																
Filename	2101																
Roi file	g2oct06.roi																
Date	160207																
Time (ks)	80.00																
Mass (g)	43				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	2569	58	32.11	0.73	25.81	0.74	456	14	1.47	0.05							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1666	64	20.83	0.80	0.32	0.85	4	10	0.31	0.81	TRUE	0.04	0.01	full	13.30	1.06	
	2060	70	25.75	0.88	2.80	0.93	28	9	2.29	0.76	TRUE	0.32	0.01	preRn	0.48	0.05	
226-Ra (23	1438	66	17.98	0.83	0.65	0.87	4	6	0.36	0.48	TRUE	0.13	0.03	postRn	12.82	1.01	
214-Pb																	
	309	36	3.86	0.45	2.32	0.47	13	3	1.08	0.23	TRUE	1.69	0.13				
	774	46	9.68	0.58	5.70	0.60	13	2	1.06	0.12	TRUE	5.55	0.42				
214-Bi	749	47	9.36	0.59	5.13	0.62	13	2	1.05	0.14	TRUE	4.50	0.35				
	159	33	1.99	0.41	1.14	0.43	12	5	1.01	0.39	TRUE	0.54	0.04				
	60	32	0.75	0.40	0.45	0.42	14	13	1.12	1.06	TRUE	0.08	0.01				
	156	26	1.95	0.33	0.25	0.34	3	5	0.27	0.37	FALSE	0.16	0.05				
	78	14	0.98	0.18	0.39	0.19	24	12	1.97	0.95	TRUE	0.18	0.01				
210-Pb	618	62	7.73	0.78	1.11	0.82	14	10	1.15	0.85	TRUE	0.13	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	310	34	3.88	0.43	3.35	0.44	36	5	8.92	1.22	FALSE	1.47	0.04	full	30.29	1.27	
	583	47	7.29	0.59	4.93	0.62	24	3	5.80	0.74	TRUE	2.64	0.11				
	503	63	6.29	0.79	2.94	0.83	18	5	4.37	1.24	TRUE	0.70	0.04				
224-Ra																	
212-Pb	3121	115	39.01	1.44	29.79	1.51	22	1	5.33	0.28	TRUE	17.07	0.79				
212-Bi	129	35	1.61	0.44	0.96	0.46	17	8	4.27	2.08	TRUE	0.24	0.01				
208-Tl	161	43	2.01	0.54	1.43	0.57	54	22	13.25	5.47	TRUE	0.11	0.00				
	995	52	12.44	0.65	9.44	0.68	31	2	7.53	0.56	FALSE	5.94	0.19				
	57	26	0.71	0.33	0.42	0.34	15	12	3.72	3.03	TRUE	0.10	0.01				
	580	30	7.25	0.38	3.03	0.39	28	4	6.80	0.91	TRUE	2.02	0.07				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	456	14	1.47	0.05			1.22	0.0379	0.355	0.01
WM	U	12.55	0.944	1.017	0.08	2.83	0.21	0.15	0.0112	0.117	0.01
	Th	23.8	0.786	5.867	0.19	4.34	0.14	0.17	0.0055	0.302	0.01
					Total	7.16	0.26	1.54	0.0399	0.774	0.02
Thfull/Ufull				5.77							
Pre 222Rn	U	9.67	20.1	0.783	1.63	2.18	4.52	0.11	0.2379	0.09	0.19
Post 222Rn	U	12.70	0.99	1.028	0.08	2.86	0.22	0.15	0.0117	0.118	0.01
Difference		-3.02	20.13	-0.24	1.63	-0.68	4.53	-0.04	0.24	-0.03	0.19

Detector	2																
Sample	**2091**																
Filename	2091																
Roi file	g2oct06.roi																
Date	190207																
Time (ks)	50.00																
Mass (g)	80.4				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	2572	56	51.44	1.12	45.14	1.13	483	14	1.56	0.05							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1138	56	22.76	1.12	2.26	1.15	37	19	2.98	1.54	TRUE	0.10	0.00	full	17.23	0.96	
	1452	60	29.04	1.20	6.09	1.24	45	10	3.67	0.79	FALSE	0.48	0.01	preRn	0.87	0.03	
226-Ra (23	981	56	19.62	1.12	2.30	1.16	14	7	1.11	0.56	TRUE	0.28	0.02	postRn	16.36	0.92	
214-Pb																	
	285	32	5.70	0.64	4.15	0.66	19	3	1.54	0.26	TRUE	1.82	0.10				
	751	43	15.02	0.86	11.04	0.88	18	2	1.46	0.14	TRUE	6.02	0.33				
214-Bi	702	42	14.04	0.84	9.80	0.86	16	2	1.32	0.14	TRUE	5.83	0.36				
	192	28	3.84	0.56	2.99	0.58	21	4	1.69	0.34	TRUE	1.16	0.06				
	45	29	0.90	0.58	0.60	0.59	14	14	1.17	1.17	TRUE	0.07	0.00				
	199	23	3.98	0.46	2.28	0.47	20	4	1.61	0.35	TRUE	1.06	0.05				
	46	12	0.92	0.24	0.33	0.25	12	9	0.94	0.70	TRUE	0.15	0.01				
210-Pb	499	54	9.98	1.08	3.36	1.11	33	11	2.68	0.92	TRUE	0.26	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	359	32	7.18	0.64	6.66	0.65	55	7	13.53	1.61	FALSE	1.29	0.02	full	44.87	1.28	
	671	44	13.42	0.88	11.06	0.90	32	3	7.79	0.68	TRUE	4.13	0.13				
	680	55	13.60	1.10	10.25	1.13	37	4	9.00	1.07	TRUE	1.93	0.05				
224-Ra																	
212-Pb	4151	109	83.02	2.18	73.80	2.23	34	1	8.26	0.28	TRUE	25.56	0.76				
212-Bi	196	32	3.92	0.64	3.26	0.66	37	8	9.12	1.99	TRUE	0.57	0.02				
208-Tl	121	36	2.42	0.72	1.84	0.74	36	16	8.94	3.88	TRUE	0.15	0.00				
	1110	49	22.20	0.98	19.20	1.00	37	2	9.22	0.54	TRUE	7.89	0.21				
	110	23	2.20	0.46	1.91	0.47	41	11	10.07	2.77	TRUE	0.32	0.01				
	600	27	12.00	0.54	7.78	0.55	42	4	10.23	0.91	TRUE	3.04	0.07				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	483	14	1.56	0.05			1.30	0.0386	0.377	0.01
WM	U	18.01	1.045	1.458	0.08	4.05	0.24	0.21	0.0124	0.168	0.01
	Th	35.03	0.781	8.635	0.19	6.38	0.14	0.25	0.0055	0.444	0.01
					Total	10.43	0.27	1.76	0.0409	0.988	0.02
Thfull/Ufull				5.92							
Pre 222Rn	U	25.38	29.21	2.055	2.37	5.71	6.57	0.30	0.3456	0.236	0.27
Post 222Rn	U	17.73	1.084	1.436	0.09	3.99	0.24	0.21	0.0128	0.165	0.01
Difference		7.65	29.23	0.62	2.37	1.72	6.58	0.09	0.35	0.07	0.27

Detector	2															
Sample	**2093**															
Filename	2093															
Roi file	g2oct06.roi															
Date	230207															
Time (ks)	25.00															
Mass (g)	100				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	1922	47	76.88	1.88	70.58	1.89	608	19	1.96	0.06						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	510	41	20.40	1.64	-0.10	1.66	-1	-22	-0.11	-1.76	FALSE	0.00	0.00	full	12.91	0.78
	647	43	25.88	1.72	2.93	1.75	18	11	1.42	0.85	TRUE	0.16	0.01	preRn	0.52	0.03
226-Ra (23	560	41	22.40	1.64	5.08	1.67	24	8	1.97	0.66	TRUE	0.37	0.02	postRn	12.39	0.75
214-Pb																
	155	24	6.20	0.96	4.65	0.97	17	4	1.38	0.30	TRUE	1.23	0.07			
	385	30	15.40	1.20	11.42	1.21	15	2	1.22	0.14	TRUE	4.70	0.31			
214-Bi	433	32	17.32	1.28	13.08	1.29	17	2	1.41	0.16	TRUE	4.54	0.26			
	91	21	3.64	0.84	2.79	0.85	16	5	1.27	0.39	TRUE	0.66	0.04			
	59	22	2.36	0.88	2.06	0.89	40	18	3.23	1.47	TRUE	0.12	0.00			
	128	16	5.12	0.64	3.42	0.65	24	5	1.94	0.39	TRUE	1.03	0.04			
	25	9	1.00	0.36	0.41	0.37	12	10	0.93	0.83	TRUE	0.11	0.01			
210-Pb	162	39	6.48	1.56	-0.14	1.58	-1	-12	-0.09	-1.01	FALSE	-0.01	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	187	24	7.48	0.96	6.96	0.97	46	7	11.37	1.76	TRUE	0.91	0.02	full	35.69	0.92
	528	34	21.12	1.36	18.76	1.37	43	3	10.62	0.85	TRUE	3.62	0.08			
	450	42	18.00	1.68	14.65	1.70	42	5	10.35	1.29	TRUE	1.54	0.04			
224-Ra																
212-Pb	2806	82	#####	3.28	#####	3.31	38	1	9.27	0.33	TRUE	20.61	0.55			
212-Bi	136	23	5.44	0.92	4.78	0.93	44	9	10.75	2.28	TRUE	0.51	0.01			
208-Tl	106	28	4.24	1.12	3.66	1.13	58	20	14.29	4.99	TRUE	0.14	0.00			
	681	37	27.24	1.48	24.24	1.49	38	3	9.36	0.63	TRUE	5.89	0.16			
	64	17	2.56	0.68	2.27	0.69	39	13	9.62	3.14	TRUE	0.24	0.01			
	340	21	13.60	0.84	9.38	0.85	40	4	9.92	1.04	TRUE	2.24	0.06			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	608	19	1.96	0.06			1.63	0.0509	0.473	0.01
WM	U	16.64	1.289	1.347	0.10	3.74	0.29	0.20	0.0152	0.155	0.01
	Th	38.83	1.088	9.572	0.27	7.07	0.20	0.27	0.0077	0.492	0.01
					Total	10.82	0.35	2.10	0.0536	1.12	0.02
Thfull/Ufull				7.10							
Pre 222Rn	U	19.91	37.95	1.612	3.07	4.48	8.54	0.24	0.449	0.185	0.35
Post 222Rn	U	16.52	1.334	1.338	0.11	3.72	0.30	0.20	0.0158	0.154	0.01
Difference		3.39	37.97	0.27	3.08	0.76	8.55	0.04	0.45	0.03	0.35

Detector	2																
Sample	**2103**																
Filename	2103																
Roi file	g2oct06.roi																
Date	210207																
Time (ks)	25.00																
Mass (g)	84.4				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	771	33	30.84	1.32	24.54	1.33	250	14	0.81	0.05							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	4	26	0.16	1.04	-20.34	1.08	-315	-31	-25.54	-2.49	FALSE	-0.33	0.00	full		5.74	0.76
	-256	30	-10.24	1.20	-33.19	1.24	-235	-18	-19.06	-1.46	FALSE	-0.73	0.00	preRn		-2.00	0.01
226-Ra (23	-81	35	-3.24	1.40	-20.56	1.43	-116	-11	-9.43	-0.90	FALSE	-0.94	0.01	postRn		7.75	0.75
214-Pb																	
	173	23	6.92	0.92	5.37	0.93	23	4	1.89	0.35	FALSE	1.26	0.05				
	196	27	7.84	1.08	3.86	1.09	6	2	0.49	0.14	TRUE	2.00	0.33				
214-Bi	315	28	12.60	1.12	8.36	1.14	13	2	1.07	0.16	FALSE	3.56	0.27				
	57	19	2.28	0.76	1.43	0.77	9	5	0.77	0.42	TRUE	0.36	0.04				
	27	18	1.08	0.72	0.78	0.73	18	17	1.45	1.38	TRUE	0.06	0.00				
	116	15	4.64	0.60	2.94	0.61	24	5	1.98	0.43	FALSE	0.86	0.04				
	10	8	0.40	0.32	-0.19	0.33	-6	-11	-0.50	-0.87	FALSE	-0.05	0.01				
210-Pb	19	33	0.76	1.32	-5.86	1.34	-55	-14	-4.44	-1.10	FALSE	-0.30	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	-11	17	-0.44	0.68	-0.96	0.69	-8	-5	-1.86	-1.34	FALSE	-0.25	0.03	full		14.79	1.06
	225	27	9.00	1.08	6.64	1.10	18	3	4.45	0.75	TRUE	1.96	0.11				
	252	39	10.08	1.56	6.73	1.58	23	5	5.63	1.35	TRUE	0.76	0.03				
224-Ra																	
212-Pb	967	72	38.68	2.88	29.46	2.92	13	1	3.14	0.32	TRUE	7.80	0.61				
212-Bi	51	22	2.04	0.88	1.38	0.89	15	10	3.68	2.39	TRUE	0.16	0.01				
208-Tl	43	25	1.72	1.00	1.14	1.02	21	19	5.27	4.78	TRUE	0.06	0.00				
	254	30	10.16	1.20	7.16	1.22	13	2	3.27	0.56	TRUE	2.55	0.19				
	35	16	1.40	0.64	1.11	0.65	23	14	5.58	3.33	TRUE	0.12	0.01				
	231	18	9.24	0.72	5.02	0.73	26	4	6.29	0.97	FALSE	1.63	0.06				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	250	14	0.81	0.05			0.67	0.038	0.195	0.01
WM	U	7.57	1.319	0.613	0.11	1.70	0.30	0.09	0.0156	0.07	0.01
	Th	13.93	0.941	3.433	0.23	2.54	0.17	0.10	0.0066	0.176	0.01
					Total	4.24	0.34	0.86	0.0416	0.442	0.02
Thfull/Ufull				5.60							
Pre 222Rn	U	#####	81.62	-13.3	6.61	-36.83	18.37	-1.94	0.9657	-1.52	0.76
Post 222Rn	U	10.39	1.341	0.841	0.11	2.34	0.30	0.12	0.0159	0.097	0.01
Difference		#####	81.63	-14.09	6.61	-39.17	18.37	-2.06	0.97	-1.62	0.76

Detector	3																
Sample	**2097**																
Filename	2097																
Roi file	g3aug05.roi																
Date	140207																
Time (ks)	80.00																
Mass (g)	49.1																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error		Concentration error		Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	2740	57	34.25	0.71	26.55	0.73	581	18	1.88	0.06							
238-U							238U		ppm eU	error			x/sigm	1/sigm	sum		
234-Th	2960	83	37.00	1.04	0.59	1.10	7	13	0.56	1.03	TRUE		0.04	0.01	full	11.83	0.97
	3679	80	45.99	1.00	2.63	1.06	23	9	1.84	0.74	TRUE		0.27	0.01	preRn	0.50	0.04
226-Ra (23	1778	71	22.23	0.89	1.13	0.94	8	6	0.62	0.52	TRUE		0.19	0.02	postRn	11.33	0.93
214-Pb																	
	352	38	4.40	0.48	2.11	0.50	10	2	0.81	0.20	TRUE		1.69	0.17			
	855	49	10.69	0.61	6.15	0.64	14	2	1.10	0.13	TRUE		5.41	0.40			
214-Bi	701	49	8.76	0.61	4.04	0.64	11	2	0.91	0.15	TRUE		3.14	0.28			
	168	38	2.10	0.48	1.54	0.50	18	6	1.49	0.49	TRUE		0.49	0.03			
	34	35	0.43	0.44	0.05	0.46	2	17	0.16	1.37	TRUE		0.01	0.00			
	208	22	2.60	0.28	0.70	0.29	11	5	0.91	0.38	TRUE		0.50	0.04			
	92	26	1.15	0.33	0.56	0.34	48	31	3.91	2.53	TRUE		0.05	0.00			
210-Pb	328	36	4.10	0.45	0.22	0.48	6	13	0.48	1.03	TRUE		0.04	0.01			
232-Th							232Th		ppm eTh	error					sum		
228-Ac	492	52	6.15	0.65	5.45	0.68	35	5	8.72	1.17	TRUE		1.57	0.04	full	22.74	0.58
	739	47	9.24	0.59	6.90	0.61	39	4	9.64	0.92	TRUE		2.80	0.07			
	958	75	11.98	0.94	5.29	0.99	44	8	10.74	2.09	TRUE		0.60	0.01			
224-Ra																	
212-Pb	4287	136	53.59	1.70	39.62	1.78	38	2	9.34	0.46	TRUE		11.11	0.29			
212-Bi	244	47	3.05	0.59	1.77	0.62	38	14	9.28	3.39	TRUE		0.20	0.01			
208-Tl	222	64	2.78	0.80	1.43	0.85	41	25	10.16	6.26	TRUE		0.06	0.00			
	1053	51	13.16	0.64	9.65	0.66	40	3	9.88	0.73	TRUE		4.52	0.11			
	126	33	1.58	0.41	1.31	0.44	46	17	11.41	4.12	TRUE		0.17	0.00			
	731	30	9.14	0.38	4.14	0.39	50	5	12.35	1.34	FALSE		1.70	0.03			

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	581	18	1.88	0.06			1.56	0.0496	0.453	0.01
WM	U	12.16	1.028	0.985	0.08	2.74	0.23	0.14	0.0122	0.113	0.01
	Th	39.18	1.723	9.657	0.42	7.14	0.31	0.28	0.0121	0.496	0.02
					Total	9.87	0.39	1.98	0.0525	1.062	0.03
Thfull/Ufull				9.80							
Pre 222Rn	U	11.75	23.5	0.952	1.90	2.65	5.29	0.14	0.2781	0.109	0.22
Post 222Rn	U	12.18	1.075	0.987	0.09	2.74	0.24	0.14	0.0127	0.113	0.01
Difference		-0.43	23.53	-0.03	1.91	-0.10	5.30	-0.01	0.28	0.00	0.22

Detector	3															
Sample	**2099**															
Filename	2099															
Roi file	g3aug05.roi															
Date	150207															
Time (ks)	80.00															
Mass (g)	50				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	2015	50	25.19	0.63	17.48	0.64	376	15	1.22	0.05						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	3008	81	37.60	1.01	1.19	1.07	14	12	1.10	0.99	TRUE	0.09	0.01	full	10.34	1.15
	3728	78	46.60	0.98	3.25	1.03	27	9	2.22	0.72	FALSE	0.35	0.01	preRn	0.85	0.05
226-Ra (23	1877	70	23.46	0.88	2.37	0.93	16	6	1.28	0.51	TRUE	0.40	0.03	postRn	9.50	1.10
214-Pb																
	302	37	3.78	0.46	1.49	0.49	7	2	0.56	0.19	TRUE	1.31	0.19			
	680	47	8.50	0.59	3.96	0.62	9	1	0.69	0.11	TRUE	4.30	0.50			
214-Bi	630	47	7.88	0.59	3.15	0.62	9	2	0.70	0.14	TRUE	2.79	0.32			
	143	36	1.79	0.45	1.23	0.48	14	6	1.17	0.46	TRUE	0.45	0.03			
	29	32	0.36	0.40	-0.01	0.42	0	-15	-0.03	-1.24	FALSE	0.00	0.00			
	215	22	2.69	0.28	0.79	0.29	12	5	1.01	0.38	TRUE	0.57	0.05			
	80	25	1.00	0.31	0.41	0.33	35	29	2.81	2.36	TRUE	0.04	0.00			
210-Pb	329	34	4.11	0.43	0.23	0.45	6	12	0.50	0.96	TRUE	0.04	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	327	49	4.09	0.61	3.38	0.65	22	4	5.32	1.05	TRUE	1.19	0.06	full	14.31	0.76
	425	43	5.31	0.54	2.98	0.57	17	3	4.09	0.79	TRUE	1.62	0.10			
	750	72	9.38	0.90	2.69	0.95	22	8	5.36	1.93	TRUE	0.36	0.02			
224-Ra																
212-Pb	2629	129	32.86	1.61	18.90	1.70	18	2	4.37	0.40	TRUE	6.67	0.38			
212-Bi	150	45	1.88	0.56	0.60	0.60	12	13	3.07	3.08	TRUE	0.08	0.01			
208-Tl	95	63	1.19	0.79	-0.15	0.84	-4	-24	-1.07	-5.81	FALSE	-0.01	0.00			
	703	47	8.79	0.59	5.28	0.62	22	3	5.31	0.64	TRUE	3.22	0.15			
	55	32	0.69	0.40	0.42	0.42	15	15	3.59	3.66	TRUE	0.07	0.00			
	532	26	6.65	0.33	1.65	0.34	20	4	4.84	1.03	TRUE	1.12	0.06			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	376	15	1.22	0.05			1.01	0.0405	0.293	0.01
WM	U	9.00	0.87	0.729	0.07	2.03	0.20	0.11	0.0103	0.084	0.01
	Th	18.72	1.308	4.615	0.32	3.41	0.24	0.13	0.0092	0.237	0.02
					Total	5.44	0.31	1.25	0.0428	0.614	0.02
Thfull/Ufull				6.33							
Pre 222Rn	U	18.77	22.19	1.52	1.80	4.22	4.99	0.22	0.2626	0.175	0.21
Post 222Rn	U	8.60	0.906	0.697	0.07	1.94	0.20	0.10	0.0107	0.08	0.01
Difference		10.16	22.21	0.82	1.80	2.29	5.00	0.12	0.26	0.09	0.21

Detector	3															
Sample	**2105**															
Filename	2105															
Roi file	g3aug05.roi															
Date	160207															
Time (ks)	80.00															
Mass (g)	50				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	1926	50	24.08	0.63	16.37	0.64	352	15	1.14	0.05						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	3052	81	38.15	1.01	1.74	1.07	20	12	1.61	0.99	TRUE	0.13	0.01	full	15.31	0.84
	3803	78	47.54	0.98	4.18	1.03	35	9	2.86	0.72	TRUE	0.44	0.01	preRn	1.14	0.04
226-Ra (23	1965	71	24.56	0.89	3.47	0.94	23	6	1.87	0.52	TRUE	0.57	0.02	postRn	14.17	0.80
214-Pb																
	509	40	6.36	0.50	4.07	0.52	19	3	1.53	0.21	TRUE	2.69	0.14			
	1083	51	13.54	0.64	9.00	0.67	19	2	1.58	0.14	TRUE	6.25	0.32			
214-Bi	854	50	10.68	0.63	5.95	0.66	16	2	1.32	0.16	TRUE	4.10	0.25			
	150	37	1.88	0.46	1.32	0.49	15	6	1.25	0.47	TRUE	0.46	0.03			
	58	33	0.73	0.41	0.35	0.43	13	16	1.03	1.28	TRUE	0.05	0.00			
	229	24	2.86	0.30	0.96	0.31	15	5	1.23	0.41	TRUE	0.59	0.04			
	75	25	0.94	0.31	0.34	0.33	29	29	2.38	2.34	TRUE	0.04	0.00			
210-Pb	306	34	3.83	0.43	-0.05	0.45	-1	-12	-0.11	-0.96	FALSE	-0.01	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	399	51	4.99	0.64	4.28	0.67	27	4	6.73	1.10	TRUE	1.36	0.05	full	16.31	0.75
	593	44	7.41	0.55	5.08	0.58	28	3	6.97	0.83	TRUE	2.50	0.09			
	830	72	10.38	0.90	3.69	0.95	30	8	7.35	1.95	TRUE	0.48	0.02			
224-Ra																
212-Pb	2748	129	34.35	1.61	20.39	1.70	19	2	4.72	0.40	TRUE	7.15	0.37			
212-Bi	62	46	0.78	0.58	-0.50	0.61	-10	-13	-2.58	-3.14	FALSE	-0.06	0.01			
208-Tl	162	63	2.03	0.79	0.68	0.84	19	24	4.76	5.87	TRUE	0.03	0.00			
	717	46	8.96	0.58	5.45	0.60	22	3	5.48	0.63	TRUE	3.44	0.15			
	83	32	1.04	0.40	0.77	0.42	27	15	6.59	3.74	TRUE	0.12	0.00			
	545	25	6.81	0.31	1.82	0.33	22	4	5.32	1.01	TRUE	1.29	0.06			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	352	15	1.14	0.05			0.94	0.0401	0.274	0.01
WM	U	18.23	1.191	1.477	0.10	4.10	0.27	0.22	0.0141	0.17	0.01
	Th	21.61	1.325	5.326	0.33	3.94	0.24	0.15	0.0093	0.274	0.02
					Total	8.04	0.36	1.31	0.0435	0.718	0.02
Thfull/Ufull				3.61							
Pre 222Rn	U	26.14	22.93	2.117	1.86	5.88	5.16	0.31	0.2713	0.243	0.21
Post 222Rn	U	17.80	1.256	1.442	0.10	4.01	0.28	0.21	0.0149	0.166	0.01
Difference		8.34	22.96	0.68	1.86	1.88	5.17	0.10	0.27	0.08	0.21

Detector	3																
Sample	**2085**																
Filename	2085																
Roi file	g3aug05.roi																
Date	220207																
Time (ks)	50.00																
Mass (g)	99																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error		Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	3691	63	73.82	1.26	66.12	1.27	777	20	2.51	0.06							
238-U							238U		ppm eU	error			x/sigma^2	1/sigma^	sum		
234-Th	2216	77	44.32	1.54	7.91	1.58	48	10	3.86	0.81	TRUE		0.48	0.01	full	19.08	0.34
	2839	73	56.78	1.46	13.43	1.50	57	7	4.62	0.58	TRUE		1.12	0.02	preRn	2.97	0.05
226-Ra (23	1775	67	35.50	1.34	14.41	1.37	57	6	4.63	0.52	TRUE		1.38	0.02	postRn	16.11	0.28
214-Pb																	
	1031	45	20.62	0.90	18.33	0.91	51	4	4.10	0.31	TRUE		3.43	0.07			
	2629	61	52.58	1.22	48.04	1.24	61	4	4.92	0.29	TRUE		4.78	0.08			
214-Bi	2147	58	42.94	1.16	38.22	1.18	59	4	4.75	0.29	TRUE		4.48	0.08			
	366	38	7.32	0.76	6.76	0.78	48	7	3.88	0.53	TRUE		1.12	0.02			
	168	33	3.36	0.66	2.99	0.67	70	19	5.65	1.53	TRUE		0.20	0.00			
	418	24	8.36	0.48	6.46	0.49	64	7	5.21	0.53	TRUE		1.50	0.02			
	90	24	1.80	0.48	1.21	0.49	42	18	3.37	1.47	TRUE		0.13	0.00			
210-Pb	387	34	7.74	0.68	3.86	0.70	52	10	4.22	0.84	TRUE		0.48	0.01			
232-Th							232Th		ppm eTh	error					sum		
228-Ac	661	50	13.22	1.00	12.52	1.02	39	4	9.62	0.88	FALSE		3.06	0.08	full	36.27	0.77
	882	45	17.64	0.90	15.31	0.92	44	3	10.93	0.76	TRUE		4.71	0.11			
	955	68	19.10	1.36	12.41	1.40	44	5	10.95	1.34	TRUE		1.49	0.03			
224-Ra																	
212-Pb	5199	130	#####	2.60	90.02	2.66	47	2	11.68	0.41	TRUE		17.08	0.36			
212-Bi	334	43	6.68	0.86	5.40	0.88	63	12	15.45	3.04	TRUE		0.41	0.01			
208-Tl	129	58	2.58	1.16	1.24	1.19	26	26	6.42	6.36	TRUE		0.04	0.00			
	1340	50	26.80	1.00	23.29	1.02	52	3	12.77	0.67	TRUE		6.96	0.13			
	147	30	2.94	0.60	2.67	0.62	55	15	13.47	3.60	TRUE		0.26	0.00			
	635	27	12.70	0.54	7.70	0.55	49	5	12.14	1.15	TRUE		2.27	0.05			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamma	error
Full Series	K	777	20	2.51	0.06			2.09	0.0539	0.60575	0.02
WM	U	56.43	2.958	4.57	0.24	12.70	0.67	0.67	0.035	0.52511	0.03
	Th	47	1.296	11.59	0.32	8.56	0.24	0.33	0.0091	0.59548	0.02
					Total	21.26	0.71	3.09	0.0649	1.72634	0.04
Thfull/Ufull				2.54							
Pre 222Rn	U	55.37	18.64	4.484	1.51	12.46	4.19	0.66	0.2205	0.5152	0.17
Post 222Rn	U	56.63	3.515	4.586	0.28	12.75	0.79	0.67	0.0416	0.52698	0.03
Difference		-1.27	18.97	-0.10	1.54	-0.28	4.27	-0.01	0.22	-0.01	0.18

Detector	3																
Sample	**2086**																
Filename	2086																
Roi file	g3aug05.roi																
Date	210207																
Time (ks)	50.00																
Mass (g)	98.1																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error		Concentration error		Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	3562	63	71.24	1.26	63.54	1.27	754	20	2.44	0.06							
238-U							238U		ppm eU	error			x/sigm	1/sigm	sum		
234-Th	2452	79	49.04	1.58	12.63	1.62	77	11	6.22	0.89	TRUE		0.64	0.01	full	18.87	0.32
	2783	72	55.66	1.44	12.31	1.48	53	7	4.27	0.57	TRUE		1.07	0.02	preRn	3.06	0.05
226-Ra (23	1758	67	35.16	1.34	14.07	1.37	56	6	4.56	0.52	TRUE		1.35	0.02	postRn	15.81	0.27
214-Pb																	
	1154	46	23.08	0.92	20.79	0.93	58	4	4.70	0.34	TRUE		3.27	0.06			
	2596	62	51.92	1.24	47.38	1.25	60	4	4.90	0.29	TRUE		4.74	0.08			
214-Bi	2144	58	42.88	1.16	38.16	1.18	59	4	4.78	0.30	TRUE		4.44	0.08			
	415	37	8.30	0.74	7.74	0.76	55	7	4.48	0.55	TRUE		1.20	0.02			
	175	33	3.50	0.66	3.13	0.67	74	19	5.97	1.56	TRUE		0.20	0.00			
	431	25	8.62	0.50	6.72	0.51	68	7	5.47	0.56	TRUE		1.43	0.02			
	67	25	1.34	0.50	0.75	0.51	26	18	2.10	1.48	TRUE		0.08	0.00			
210-Pb	386	35	7.72	0.70	3.84	0.72	52	11	4.23	0.87	TRUE		0.45	0.01			
232-Th							232Th		ppm eTh	error					sum		
228-Ac	768	49	15.36	0.98	14.66	1.00	46	4	11.37	0.91	TRUE		3.39	0.07	full	36.23	0.76
	1023	46	20.46	0.92	18.13	0.94	53	3	13.06	0.81	TRUE		4.87	0.09			
	905	68	18.10	1.36	11.41	1.40	41	5	10.16	1.34	TRUE		1.39	0.03			
224-Ra																	
212-Pb	5116	130	#####	2.60	88.36	2.66	47	2	11.57	0.41	TRUE		16.79	0.36			
212-Bi	272	43	5.44	0.86	4.16	0.88	49	12	12.01	2.86	TRUE		0.36	0.01			
208-Tl	106	58	2.12	1.16	0.78	1.19	17	26	4.07	6.31	TRUE		0.03	0.00			
	1262	49	25.24	0.98	21.73	1.00	49	3	12.02	0.66	TRUE		6.90	0.14			
	154	30	3.08	0.60	2.81	0.62	58	15	14.29	3.68	TRUE		0.26	0.00			
	615	27	12.30	0.54	7.30	0.55	47	5	11.62	1.13	TRUE		2.23	0.05			

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	754	20	2.44	0.06			2.02	0.0535	0.587	0.02
WM	U	59.03	3.128	4.78	0.25	13.28	0.70	0.70	0.037	0.549	0.03
	Th	47.71	1.317	11.76	0.32	8.69	0.24	0.34	0.0093	0.604	0.02
					Total	21.98	0.74	3.06	0.0657	1.741	0.04
Thfull/Ufull				2.46							
Pre 222Rn	U	58.21	19.03	4.714	1.54	13.10	4.28	0.69	0.2252	0.542	0.18
Post 222Rn	U	59.19	3.743	4.793	0.30	13.32	0.84	0.70	0.0443	0.551	0.03
Difference		-0.98	19.40	-0.08	1.57	-0.22	4.37	-0.01	0.23	-0.01	0.18

Detector	3															
Sample	**2090**															
Filename	2090															
Roi file	g3aug05.roi															
Date	260207															
Time (ks)	50.00															
Mass (g)	92.3				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	2446	53	48.92	1.06	41.22	1.07	520	16	1.68	0.05						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	1889	69	37.78	1.38	1.37	1.42	9	9	0.72	0.75	TRUE	0.10	0.01	full	20.12	1.11
	2369	65	47.38	1.30	4.03	1.34	18	6	1.49	0.50	TRUE	0.48	0.03	preRn	1.09	0.07
226-Ra (23	1222	59	24.44	1.18	3.35	1.22	14	5	1.15	0.43	TRUE	0.51	0.04	postRn	19.02	1.04
214-Pb																
	425	35	8.50	0.70	6.21	0.72	18	2	1.49	0.19	TRUE	3.27	0.18			
	938	44	18.76	0.88	14.22	0.90	19	2	1.56	0.13	TRUE	7.62	0.40			
214-Bi	745	42	14.90	0.84	10.18	0.86	17	2	1.36	0.14	TRUE	5.94	0.35			
	155	31	3.10	0.62	2.54	0.64	19	5	1.56	0.41	TRUE	0.75	0.04			
	96	29	1.92	0.58	1.55	0.60	39	16	3.14	1.30	TRUE	0.15	0.00			
	175	19	3.50	0.38	1.60	0.39	17	4	1.39	0.35	TRUE	0.91	0.05			
	61	20	1.22	0.40	0.63	0.42	23	16	1.88	1.28	TRUE	0.09	0.00			
210-Pb	277	30	5.54	0.60	1.66	0.62	24	9	1.95	0.75	TRUE	0.28	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	556	46	11.12	0.92	10.42	0.94	35	3	8.59	0.86	TRUE	2.89	0.08	full	32.91	0.93
	758	41	15.16	0.82	12.83	0.84	40	3	9.82	0.73	TRUE	4.58	0.11			
	806	62	16.12	1.24	9.43	1.28	36	5	8.92	1.29	TRUE	1.33	0.04			
224-Ra																
212-Pb	3759	116	75.18	2.32	61.22	2.38	35	1	8.52	0.37	TRUE	15.39	0.45			
212-Bi	128	40	2.56	0.80	1.28	0.82	16	10	3.93	2.56	TRUE	0.15	0.01			
208-Tl	230	54	4.60	1.08	3.26	1.12	73	30	18.11	7.51	TRUE	0.08	0.00			
	932	44	18.64	0.88	15.13	0.90	36	2	8.90	0.59	TRUE	6.30	0.17			
	97	27	1.94	0.54	1.67	0.56	37	13	9.03	3.25	TRUE	0.21	0.01			
	486	25	9.72	0.50	4.72	0.51	32	4	7.98	1.00	TRUE	1.99	0.06			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	520	16	1.68	0.05			1.39	0.0435	0.405	0.01
WM	U	18.08	0.899	1.464	0.07	4.07	0.20	0.21	0.0106	0.168	0.01
	Th	35.32	1.073	8.706	0.26	6.43	0.20	0.25	0.0076	0.448	0.01
					Total	10.50	0.28	1.86	0.0455	1.021	0.02
Thfull/Ufull				5.95							
Pre 222Rn	U	14.84	13.56	1.202	1.10	3.34	3.05	0.18	0.1604	0.138	0.13
Post 222Rn	U	18.31	0.962	1.482	0.08	4.12	0.22	0.22	0.0114	0.17	0.01
Difference		-3.47	13.59	-0.28	1.10	-0.78	3.06	-0.04	0.16	-0.03	0.13

Detector	3																
Sample	**2092**																
Filename	2092																
Roi file	g3aug05.roi																
Date	260207																
Time (ks)	25.00																
Mass (g)	100				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	1367	39	54.68	1.56	46.98	1.57	547	21	1.77	0.07							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	928	49	37.12	1.96	0.71	1.99	4	12	0.34	0.96	TRUE	0.03	0.01	full	13.68	0.76	
	1183	46	47.32	1.84	3.97	1.87	17	8	1.35	0.64	TRUE	0.27	0.02	preRn	0.64	0.04	
226-Ra (23	629	42	25.16	1.68	4.07	1.71	16	7	1.29	0.55	TRUE	0.35	0.02	postRn	13.04	0.71	
214-Pb																	
	232	24	9.28	0.96	6.99	0.97	19	3	1.55	0.23	TRUE	2.31	0.12				
	479	31	19.16	1.24	14.62	1.25	18	2	1.48	0.15	TRUE	5.38	0.29				
214-Bi	400	30	16.00	1.20	11.28	1.22	17	2	1.39	0.17	TRUE	4.03	0.24				
	93	23	3.72	0.92	3.16	0.93	22	7	1.80	0.55	TRUE	0.49	0.02				
	46	20	1.84	0.80	1.47	0.81	34	19	2.75	1.57	TRUE	0.09	0.00				
	84	14	3.36	0.56	1.46	0.57	14	6	1.17	0.46	TRUE	0.45	0.03				
	57	14	2.28	0.56	1.69	0.57	58	21	4.66	1.74	TRUE	0.12	0.00				
210-Pb	144	22	5.76	0.88	1.88	0.89	25	12	2.03	0.98	TRUE	0.17	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	260	31	10.40	1.24	9.70	1.26	30	4	7.38	1.01	TRUE	1.80	0.06	full	20.18	0.63	
	361	29	14.44	1.16	12.11	1.17	35	4	8.56	0.88	TRUE	2.72	0.08				
	390	46	15.60	1.84	8.91	1.87	32	7	7.78	1.67	TRUE	0.68	0.02				
224-Ra																	
212-Pb	1794	82	71.76	3.28	57.80	3.32	30	2	7.42	0.45	TRUE	9.04	0.30				
212-Bi	120	28	4.80	1.12	3.52	1.14	40	14	9.97	3.40	TRUE	0.21	0.01				
208-Tl	90	37	3.60	1.48	2.26	1.51	47	33	11.59	8.19	TRUE	0.04	0.00				
	524	31	20.96	1.24	17.45	1.25	38	3	9.47	0.74	FALSE	4.32	0.11				
	41	19	1.64	0.76	1.37	0.77	28	16	6.84	3.96	TRUE	0.11	0.00				
	234	17	9.36	0.68	4.36	0.69	28	5	6.81	1.15	TRUE	1.26	0.05				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	547	21	1.77	0.07			1.47	0.0552	0.426	0.02
WM	U	18.02	1.318	1.46	0.11	4.06	0.30	0.21	0.0156	0.168	0.01
	Th	32.13	1.592	7.918	0.39	5.85	0.29	0.23	0.0112	0.407	0.02
					Total	9.91	0.41	1.91	0.0584	1.001	0.03
Thfull/Ufull				5.42							
Pre 222Rn	U	14.38	22.35	1.165	1.81	3.24	5.03	0.17	0.2645	0.134	0.21
Post 222Rn	U	18.25	1.4	1.478	0.11	4.11	0.32	0.22	0.0166	0.17	0.01
Difference		-3.87	22.40	-0.31	1.81	-0.87	5.04	-0.05	0.27	-0.04	0.21

Detector	3																
Sample	**2094**																
Filename	2094																
Roi file	g3aug05.roi																
Date	190207																
Time (ks)	50.00																
Mass (g)	100					Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	3833	65	76.66	1.30	68.96	1.31	803	21	2.60	0.07							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	2844	91	56.88	1.82	20.47	1.85	122	13	9.89	1.09	FALSE	0.67	0.01	full		22.30	1.26
	2483	68	49.66	1.36	6.31	1.40	27	6	2.15	0.49	TRUE	0.72	0.03	preRn		1.93	0.07
226-Ra (23	1221	60	24.42	1.20	3.33	1.24	13	5	1.06	0.40	TRUE	0.54	0.04	postRn		20.38	1.19
214-Pb																	
	409	35	8.18	0.70	5.89	0.72	16	2	1.31	0.18	TRUE	3.43	0.21				
	903	44	18.06	0.88	13.52	0.90	17	1	1.37	0.12	TRUE	8.17	0.48				
214-Bi	771	44	15.42	0.88	10.70	0.90	16	2	1.32	0.13	TRUE	6.18	0.38				
	218	34	4.36	0.68	3.80	0.70	27	5	2.16	0.43	TRUE	0.96	0.04				
	108	31	2.16	0.62	1.79	0.63	41	16	3.35	1.29	TRUE	0.16	0.00				
	208	19	4.16	0.38	2.26	0.39	22	4	1.81	0.34	TRUE	1.29	0.06				
	59	23	1.18	0.46	0.59	0.47	20	16	1.62	1.33	TRUE	0.07	0.00				
210-Pb	225	31	4.50	0.62	0.62	0.64	8	9	0.67	0.69	TRUE	0.11	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	819	49	16.38	0.98	15.68	1.00	48	4	11.93	0.91	TRUE	3.56	0.07	full		37.98	0.84
	894	44	17.88	0.88	15.55	0.90	45	3	10.99	0.74	TRUE	4.95	0.11				
	962	67	19.24	1.34	12.55	1.38	44	5	10.96	1.32	TRUE	1.56	0.03				
224-Ra																	
212-Pb	4866	124	97.32	2.48	83.36	2.54	43	2	10.71	0.38	TRUE	17.81	0.41				
212-Bi	311	42	6.22	0.84	4.94	0.86	57	12	13.99	2.88	TRUE	0.42	0.01				
208-Tl	341	55	6.82	1.10	5.48	1.13	114	36	28.10	8.80	TRUE	0.09	0.00				
	1282	49	25.64	0.98	22.13	1.00	49	3	12.01	0.65	TRUE	7.08	0.15				
	169	29	3.38	0.58	3.11	0.60	63	15	15.52	3.64	TRUE	0.29	0.00				
	587	27	11.74	0.54	6.74	0.55	43	4	10.52	1.08	TRUE	2.23	0.05				

Sample		Specific Activity (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	803	21	2.60	0.07			2.15	0.0553	0.625	0.02
WM	U	17.64	0.791	1.429	0.06	3.97	0.18	0.21	0.0094	0.164	0.01
	Th	45.225	1.191	11.15	0.29	8.24	0.22	0.32	0.0084	0.573	0.02
					Total	12.21	0.28	2.68	0.0567	1.363	0.02
Thfull/Ufull				7.80							
Pre 222Rn	U	26.18	13.58	2.12	1.10	5.89	3.06	0.31	0.1607	0.244	0.13
Post 222Rn	U	17.12	0.84	1.386	0.07	3.85	0.19	0.20	0.0099	0.159	0.01
Difference		9.06	13.61	0.73	1.10	2.04	3.06	0.11	0.16	0.08	0.13

Detector	3																
Sample	**2100**																
Filename	2100																
Roi file	g3aug05.roi																
Date	230207																
Time (ks)	25.00																
Mass (g)	74.9					Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error			error	2 err of WM ?					
							K		%K								
40-K	886	33	35.44	1.32	27.74	1.33	431	22	1.39	0.07							
238-U							238U		ppm eU	error			x/sigm	1/sigm	sum		
234-Th	1085	49	43.40	1.96	6.99	1.99	56	16	4.51	1.32	FALSE		0.21	0.00	full	8.61	0.48
	1160	45	46.40	1.80	3.05	1.83	17	10	1.39	0.84	TRUE		0.16	0.01	preRn	0.51	0.03
226-Ra (23	577	41	23.08	1.64	1.99	1.67	10	9	0.84	0.71	TRUE		0.14	0.01	postRn	8.11	0.46
214-Pb																	
	176	23	7.04	0.92	4.75	0.93	17	4	1.41	0.29	TRUE		1.38	0.08			
	407	30	16.28	1.20	11.74	1.22	20	2	1.59	0.18	TRUE		3.77	0.19			
214-Bi	332	30	13.28	1.20	8.56	1.22	17	3	1.40	0.21	TRUE		2.50	0.14			
	19	21	0.76	0.84	0.20	0.85	2	8	0.15	0.65	TRUE		0.03	0.02			
	14	19	0.56	0.76	0.19	0.77	6	24	0.47	1.93	TRUE		0.01	0.00			
	80	13	3.20	0.52	1.30	0.53	17	7	1.39	0.57	TRUE		0.34	0.02			
	23	15	0.92	0.60	0.33	0.61	15	28	1.20	2.26	TRUE		0.02	0.00			
210-Pb	115	21	4.60	0.84	0.72	0.85	13	15	1.04	1.24	TRUE		0.06	0.00			
232-Th							232Th		ppm eTh	error					sum		
228-Ac	195	31	7.80	1.24	7.10	1.26	29	5	7.21	1.31	TRUE		1.03	0.04	full	14.69	0.38
	359	27	14.36	1.08	12.03	1.09	46	4	11.35	1.11	TRUE		2.29	0.05			
	359	44	14.36	1.76	7.67	1.79	36	9	8.94	2.13	TRUE		0.49	0.01			
224-Ra																	
212-Pb	1723	79	68.92	3.16	54.96	3.21	38	2	9.42	0.58	TRUE		6.94	0.18			
212-Bi	98	29	3.92	1.16	2.64	1.18	41	19	9.99	4.58	TRUE		0.12	0.00			
208-Tl	55	38	2.20	1.52	0.86	1.55	24	43	5.88	10.67	TRUE		0.01	0.00			
	417	30	16.68	1.20	13.17	1.21	39	4	9.54	0.92	TRUE		2.76	0.07			
	62	20	2.48	0.80	2.21	0.81	60	23	14.73	5.76	TRUE		0.11	0.00			
	235	17	9.40	0.68	4.40	0.69	37	6	9.17	1.54	TRUE		0.95	0.03			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	431	22	1.39	0.07			1.16	0.0589	0.336	0.02
WM	U	17.77	2.063	1.439	0.17	4.00	0.46	0.21	0.0244	0.165	0.02
	Th	38.48	2.619	9.484	0.65	7.01	0.48	0.27	0.0185	0.487	0.03
					Total	11.01	0.67	1.64	0.0664	0.989	0.04
Thfull/Ufull				6.59							
Pre 222Rn	U	19.39	38.27	1.57	3.10	4.36	8.61	0.23	0.4528	0.18	0.36
Post 222Rn	U	17.68	2.181	1.432	0.18	3.98	0.49	0.21	0.0258	0.165	0.02
Difference		1.71	38.33	0.14	3.10	0.38	8.63	0.02	0.45	0.02	0.36

Detector	3															
Sample	**2102**															
Filename	2102															
Roi file	g3aug05.roi															
Date	220207															
Time (ks)	25.00															
Mass (g)	82.7				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	958	33	38.32	1.32	30.62	1.33	431	20	1.39	0.07						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	966	47	38.64	1.88	2.23	1.91	16	14	1.30	1.12	TRUE	0.08	0.01	full	7.26	0.69
	1168	45	46.72	1.80	3.37	1.83	17	9	1.39	0.76	TRUE	0.20	0.01	preRn	0.37	0.03
226-Ra (23	555	39	22.20	1.56	1.11	1.59	5	8	0.43	0.61	TRUE	0.09	0.02	postRn	6.89	0.66
214-Pb																
	104	22	4.16	0.88	1.87	0.89	6	3	0.50	0.24	TRUE	0.70	0.11			
	336	29	13.44	1.16	8.90	1.18	13	2	1.09	0.16	TRUE	3.67	0.27			
214-Bi	265	28	10.60	1.12	5.88	1.14	11	2	0.87	0.18	TRUE	2.30	0.21			
	12	21	0.48	0.84	-0.08	0.85	-1	-7	-0.05	-0.59	FALSE	-0.01	0.02			
	25	19	1.00	0.76	0.63	0.77	18	22	1.42	1.76	TRUE	0.04	0.00			
	61	12	2.44	0.48	0.54	0.49	6	6	0.52	0.47	TRUE	0.19	0.03			
	27	15	1.08	0.60	0.49	0.61	20	25	1.63	2.06	TRUE	0.03	0.00			
210-Pb	94	20	3.76	0.80	-0.12	0.81	-2	-13	-0.15	-1.07	FALSE	-0.01	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	140	30	5.60	1.20	4.90	1.22	18	5	4.51	1.14	TRUE	0.86	0.05	full	11.21	0.55
	191	26	7.64	1.04	5.31	1.05	18	4	4.54	0.92	TRUE	1.33	0.07			
	290	43	11.60	1.72	4.91	1.75	21	8	5.19	1.86	TRUE	0.37	0.02			
224-Ra																
212-Pb	1167	76	46.68	3.04	32.72	3.09	21	2	5.08	0.49	TRUE	5.23	0.25			
212-Bi	111	26	4.44	1.04	3.16	1.06	44	15	10.83	3.81	TRUE	0.18	0.00			
208-Tl	23	36	0.92	1.44	-0.42	1.47	-11	-37	-2.61	-9.12	FALSE	-0.01	0.00			
	309	28	12.36	1.12	8.85	1.14	24	3	5.81	0.76	TRUE	2.45	0.10			
	0	18	0.00	0.72	-0.26	0.73	-6	-18	-1.59	-4.43	FALSE	-0.02	0.00			
	186	15	7.44	0.60	2.44	0.61	19	5	4.61	1.18	TRUE	0.81	0.04			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	431	20	1.39	0.07			1.16	0.054	0.336	0.02
WM	U	10.54	1.451	0.854	0.12	2.37	0.33	0.12	0.0172	0.098	0.01
	Th	20.53	1.831	5.06	0.45	3.74	0.33	0.14	0.0129	0.26	0.02
					Total	6.11	0.47	1.43	0.0581	0.694	0.03
Thfull/Ufull				5.93							
Pre 222Rn	U	10.89	29.33	0.882	2.38	2.45	6.60	0.13	0.347	0.101	0.27
Post 222Rn	U	10.52	1.526	0.852	0.12	2.37	0.34	0.12	0.0181	0.098	0.01
Difference		0.36	29.37	0.03	2.38	0.08	6.61	0.00	0.35	0.00	0.27

Detector	3															
Sample	**2104**															
Filename	2104															
Roi file	g3aug05.roi															
Date	200207															
Time (ks)	50.00															
Mass (g)	88.2				Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?					
							K		%K							
40-K	1992	48	39.84	0.96	32.14	0.97	424	15	1.37	0.05						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	1911	67	38.22	1.34	1.81	1.39	12	9	0.99	0.76	TRUE	0.14	0.01	full	18.51	1.20
	2529	65	50.58	1.30	7.23	1.34	34	7	2.79	0.54	FALSE	0.77	0.02	preRn	1.53	0.07
226-Ra (23	1256	57	25.12	1.14	4.03	1.18	18	5	1.45	0.43	TRUE	0.62	0.03	postRn	16.98	1.13
214-Pb																
	371	33	7.42	0.66	5.13	0.68	16	2	1.29	0.19	TRUE	3.02	0.19			
	768	42	15.36	0.84	10.82	0.86	15	1	1.24	0.12	TRUE	7.13	0.46			
214-Bi	648	41	12.96	0.82	8.24	0.84	14	2	1.15	0.13	TRUE	5.28	0.37			
	144	31	2.88	0.62	2.32	0.64	18	5	1.50	0.43	TRUE	0.67	0.04			
	59	27	1.18	0.54	0.81	0.56	21	15	1.72	1.21	TRUE	0.09	0.00			
	164	19	3.28	0.38	1.38	0.39	15	5	1.25	0.36	TRUE	0.76	0.05			
	12	22	0.24	0.44	-0.35	0.45	-14	-18	-1.11	-1.43	FALSE	-0.04	0.00			
210-Pb	212	29	4.24	0.58	0.36	0.60	5	9	0.44	0.74	TRUE	0.07	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	325	43	6.50	0.86	5.80	0.89	20	3	5.00	0.79	TRUE	1.97	0.10	full	24.78	1.07
	494	38	9.88	0.76	7.55	0.78	25	3	6.05	0.66	TRUE	3.43	0.14			
	543	62	10.86	1.24	4.17	1.28	17	5	4.13	1.28	TRUE	0.62	0.04			
224-Ra																
212-Pb	2680	111	53.60	2.22	39.64	2.29	23	1	5.77	0.35	TRUE	11.58	0.49			
212-Bi	87	38	1.74	0.76	0.46	0.79	6	10	1.49	2.53	TRUE	0.06	0.01			
208-Tl	89	51	1.78	1.02	0.44	1.06	10	25	2.55	6.18	TRUE	0.02	0.00			
	718	41	14.36	0.82	10.85	0.84	27	2	6.68	0.55	TRUE	5.38	0.20			
	50	26	1.00	0.52	0.73	0.54	17	13	4.14	3.10	TRUE	0.11	0.01			
	387	22	7.74	0.44	2.74	0.45	20	3	4.85	0.86	TRUE	1.64	0.08			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	424	15	1.37	0.05			1.14	0.0397	0.33	0.01
WM	U	15.43	0.833	1.249	0.07	3.47	0.19	0.18	0.0099	0.144	0.01
	Th	23.23	0.938	5.725	0.23	4.23	0.17	0.16	0.0066	0.294	0.01
					Total	7.70	0.25	1.48	0.0414	0.768	0.02
Thfull/Ufull				4.58							
Pre 222Rn	U	22.39	14.66	1.814	1.19	5.04	3.30	0.26	0.1734	0.208	0.14
Post 222Rn	U	15.01	0.884	1.215	0.07	3.38	0.20	0.18	0.0105	0.14	0.01
Difference		7.39	14.68	0.60	1.19	1.66	3.30	0.09	0.17	0.07	0.14

Detector	3																
Sample	**2103**																
Filename	2103																
Roi file	g3aug05.roi																
Date	210207																
Time (ks)	25.00																
Mass (g)	84.4																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration		error	Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	772	31	30.88	1.24	23.18	1.25	320	18	1.03	0.06							
238-U							238U		ppm eU		error		x/sigm	1/sigm	sum		
234-Th	965	46	38.60	1.84	2.19	1.87	16	13	1.26	1.08	TRUE		0.09	0.01	full	9.49	0.72
	1220	46	48.80	1.84	5.45	1.87	27	9	2.20	0.77	TRUE		0.30	0.01	preRn	0.58	0.03
226-Ra (23	584	39	23.36	1.56	2.27	1.59	11	7	0.85	0.60	TRUE		0.19	0.02	postRn	8.91	0.68
214-Pb																	
	110	22	4.40	0.88	2.11	0.89	7	3	0.55	0.24	FALSE		0.80	0.12			
	331	28	13.24	1.12	8.70	1.14	13	2	1.05	0.15	TRUE		3.90	0.30			
214-Bi	315	28	12.60	1.12	7.88	1.14	14	2	1.15	0.18	TRUE		2.98	0.21			
	82	21	3.28	0.84	2.72	0.85	23	7	1.83	0.59	TRUE		0.43	0.02			
	40	18	1.60	0.72	1.23	0.73	34	21	2.73	1.68	TRUE		0.08	0.00			
	106	13	4.24	0.52	2.34	0.53	27	6	2.22	0.52	FALSE		0.66	0.02			
	-13	16	-0.52	0.64	-1.11	0.65	-45	-27	-3.64	-2.20	FALSE		-0.06	0.00			
210-Pb	133	20	5.32	0.80	1.44	0.81	23	13	1.85	1.06	TRUE		0.13	0.01			
232-Th							232Th		ppm eTh		error				sum		
228-Ac	125	28	5.00	1.12	4.30	1.14	16	4	3.87	1.04	TRUE		0.88	0.06	full	12.03	0.58
	231	25	9.24	1.00	6.91	1.02	23	4	5.78	0.87	TRUE		1.87	0.08			
	256	43	10.24	1.72	3.55	1.75	15	7	3.67	1.82	TRUE		0.27	0.02			
224-Ra																	
212-Pb	1186	76	47.44	3.04	33.48	3.09	21	2	5.09	0.48	TRUE		5.45	0.26			
212-Bi	51	27	2.04	1.08	0.76	1.10	10	15	2.56	3.69	TRUE		0.05	0.00			
208-Tl	69	35	2.76	1.40	1.42	1.43	35	36	8.62	8.91	TRUE		0.03	0.00			
	280	27	11.20	1.08	7.69	1.10	20	3	4.95	0.72	TRUE		2.35	0.12			
	31	18	1.24	0.72	0.98	0.73	23	18	5.77	4.40	TRUE		0.07	0.00			
	219	16	8.76	0.64	3.76	0.65	28	5	6.96	1.27	TRUE		1.06	0.04			

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	320	18	1.03	0.06			0.86	0.0486	0.249	0.01
WM	U	13.25	1.396	1.073	0.11	2.98	0.31	0.16	0.0165	0.123	0.01
	Th	20.71	1.721	5.105	0.42	3.77	0.31	0.15	0.0121	0.262	0.02
					Total	6.76	0.44	1.16	0.0527	0.635	0.03
Thfull/Ufull				4.76							
Pre 222Rn	U	16.67	28.6	1.35	2.32	3.75	6.44	0.20	0.3384	0.155	0.27
Post 222Rn	U	13.08	1.468	1.059	0.12	2.94	0.33	0.15	0.0174	0.122	0.01
Difference		3.59	28.64	0.29	2.32	0.81	6.44	0.04	0.34	0.03	0.27

Detector	#3															
Sample	**2215**															
Filename	2215															
Roi file	G3nov07															
Date	16/12/07															
Time (ks)	50.00															
Mass (g)	100.00															
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration		error	Within 2 err of WM ?	WM calcs			
							K		%K							
40-K	3069	65	61.38	1.30	53.52	1.31	650	17	2.10	0.06						
238-U							238U		ppm eU		error		x/sigm	1/sigm	sum	
234-Th	1714	60	34.28	1.20	0.87	1.22	6	8	0.47	0.66	TRUE		0.09	0.02	full	17.54	0.92
	1687	74	33.74	1.48	-4.97	1.50	-29	-9	-2.31	-0.71	FALSE		-0.37	0.01	preRn	0.43	0.06
226-Ra (23	1304	60	26.08	1.20	4.74	1.22	20	5	1.65	0.43	TRUE		0.72	0.04	postRn	17.11	0.86
214-Pb																
	631	44	12.62	0.88	9.36	0.89	21	2	1.72	0.19	TRUE		4.05	0.19		
	995	57	19.90	1.14	15.73	1.15	19	2	1.56	0.14	TRUE		6.56	0.34		
214-Bi	844	59	16.88	1.18	11.91	1.19	19	2	1.53	0.17	TRUE		4.19	0.22		
	138	29	2.76	0.58	1.75	0.59	13	4	1.07	0.36	TRUE		0.66	0.05		
	108	26	2.16	0.52	1.64	0.53	36	12	2.88	0.94	TRUE		0.26	0.01		
	244	27	4.88	0.54	2.99	0.55	29	5	2.33	0.44	TRUE		0.96	0.03		
	94	31	1.88	0.62	1.12	0.63	34	19	2.75	1.56	TRUE		0.09	0.00		
210-Pb	323	32	6.46	0.64	1.96	0.65	26	9	2.12	0.71	TRUE		0.34	0.01		
232-Th							232Th		ppm eTh		error				sum	
228-Ac	747	48	14.94	0.96	13.15	0.97	46	4	11.38	0.87	TRUE		3.75	0.08	full	41.35	0.94
	776	52	15.52	1.04	13.12	1.05	42	3	10.24	0.84	TRUE		3.58	0.09		
	1014	69	20.28	1.38	13.95	1.40	58	6	14.18	1.46	FALSE		1.64	0.03		
224-Ra																
212-Pb	4627	116	92.54	2.32	78.83	2.34	42	1	10.41	0.33	TRUE		23.61	0.56		
212-Bi	237	51	4.74	1.02	4.19	1.03	48	12	11.81	2.98	TRUE		0.33	0.01		
208-Tl	153	39	3.06	0.78	1.96	0.79	35	14	8.55	3.48	TRUE		0.17	0.01		
	1246	66	24.92	1.32	21.22	1.33	46	3	11.32	0.73	TRUE		5.18	0.11		
	197	50	3.94	1.00	5.06	1.01	92	21	22.77	5.12	FALSE		0.21	0.00		
	678	33	13.56	0.66	8.29	0.68	48	4	11.77	1.00	TRUE		2.87	0.06		

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	650	17	2.10	0.06			1.75	0.0459	0.507	0.01
WM	U	19.03	1.085	1.541	0.09	4.28	0.24	0.23	0.0128	0.177	0.01
	Th	43.89	1.061	10.82	0.26	7.99	0.19	0.31	0.0075	0.556	0.01
					Total	12.28	0.31	2.28	0.0483	1.24	0.02
Thfull/Ufull				7.02							
Pre 222Rn	U	6.82	15.73	0.552	1.27	1.53	3.54	0.08	0.1861	0.063	0.15
Post 222Rn	U	19.93	1.165	1.614	0.09	4.49	0.26	0.24	0.0138	0.185	0.01
Difference		-13.11	15.77	-1.06	1.28	-2.95	3.55	-0.16	0.19	-0.12	0.15

Detector	#3																
Sample	**2216**																
Filename	2216																
Roi file	G3nov07																
Date	17/12/07																
Time (ks)	25.00																
Mass (g)	100.00																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error	Within 2 err of WM ?	WM calcs					
							K		%K								
40-K	2353	55	94.12	2.20	86.26	2.20	1048	29	3.39	0.09							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	970	47	38.80	1.88	5.39	1.89	36	13	2.92	1.03	TRUE	0.22	0.01	full		9.35	0.51
	1033	58	41.32	2.32	2.61	2.33	15	13	1.22	1.09	TRUE	0.08	0.01	preRn		0.47	0.03
226-Ra (23	589	44	23.56	1.76	2.22	1.77	10	8	0.77	0.62	TRUE	0.16	0.02	postRn		8.88	0.48
214-Pb																	
	268	32	10.72	1.28	7.46	1.29	17	3	1.37	0.25	TRUE	1.83	0.11				
	488	41	19.52	1.64	15.35	1.65	19	2	1.52	0.18	TRUE	3.78	0.20				
214-Bi	409	43	16.36	1.72	11.39	1.73	18	3	1.47	0.23	TRUE	2.16	0.12				
	104	22	4.16	0.88	3.15	0.88	24	7	1.93	0.55	TRUE	0.51	0.02				
	27	20	1.08	0.80	0.56	0.80	12	17	0.98	1.41	TRUE	0.04	0.00				
	113	19	4.52	0.76	2.63	0.77	25	7	2.05	0.61	TRUE	0.45	0.02				
	51	25	2.04	1.00	1.28	1.01	39	31	3.14	2.48	TRUE	0.04	0.00				
210-Pb	134	23	5.36	0.92	0.86	0.93	11	12	0.93	1.00	TRUE	0.08	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	607	39	24.28	1.56	22.49	1.57	79	6	19.46	1.40	TRUE	2.44	0.03	full		29.35	0.36
	740	41	29.60	1.64	27.20	1.65	86	5	21.23	1.34	TRUE	2.91	0.03				
	781	55	31.24	2.20	24.91	2.21	103	9	25.31	2.33	FALSE	1.15	0.01				
224-Ra																	
212-Pb	3984	94	#####	3.76	#####	3.77	78	2	19.23	0.54	TRUE	16.19	0.21				
212-Bi	253	39	10.12	1.56	9.57	1.57	109	19	26.97	4.66	TRUE	0.31	0.00				
208-Tl	122	30	4.88	1.20	3.78	1.21	67	22	16.50	5.35	TRUE	0.14	0.00				
	1075	53	43.00	2.12	39.30	2.13	85	5	20.97	1.18	TRUE	3.69	0.04				
	99	38	3.96	1.52	5.08	1.53	93	29	22.86	7.27	TRUE	0.11	0.00				
	513	24	20.52	0.96	15.25	0.97	88	6	21.64	1.48	TRUE	2.42	0.03				

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	1048	29	3.39	0.09			2.81	0.077	0.817	0.02
WM	U	18.44	1.972	1.493	0.16	4.15	0.44	0.22	0.0233	0.172	0.02
	Th	81.45	2.775	20.08	0.68	14.84	0.51	0.57	0.0196	1.032	0.04
					Total	18.99	0.67	3.61	0.0828	2.02	0.05
Thfull/Ufull				13.45							
Pre 222Rn	U	16.18	34.53	1.31	2.80	3.64	7.77	0.19	0.4086	0.151	0.32
Post 222Rn	U	18.57	2.091	1.504	0.17	4.18	0.47	0.22	0.0247	0.173	0.02
Difference		-2.40	34.59	-0.19	2.80	-0.54	7.79	-0.03	0.41	-0.02	0.32

Detector	#3															
Sample	**2219**															
Filename	2219															
Roi file	G3nov07															
Date	18/12/07															
Time (ks)	50.00															
Mass (g)	100.00															
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error	Within 2 err of WM ?	WM calcs				
							K		%K							
40-K	2265	56	45.30	1.12	37.44	1.13	455	14	1.47	0.05						
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum		
234-Th	1824	59	36.48	1.18	3.07	1.20	21	8	1.66	0.65	TRUE	0.32	0.02	full	13.69	1.23
	2059	74	41.18	1.48	2.47	1.50	14	9	1.15	0.70	TRUE	0.19	0.01	preRn	1.03	0.07
226-Ra (23	1227	58	24.54	1.16	3.20	1.18	14	5	1.11	0.41	TRUE	0.53	0.04	postRn	12.65	1.16
214-Pb																
	423	41	8.46	0.82	5.20	0.83	12	2	0.96	0.16	TRUE	3.02	0.26			
	668	52	13.36	1.04	9.19	1.05	11	1	0.91	0.11	TRUE	5.67	0.50			
214-Bi	554	57	11.08	1.14	6.11	1.15	10	2	0.79	0.15	TRUE	2.69	0.28			
	99	27	1.98	0.54	0.97	0.55	7	4	0.59	0.34	TRUE	0.42	0.06			
	98	24	1.96	0.48	1.44	0.49	31	11	2.52	0.87	TRUE	0.27	0.01			
	132	24	2.64	0.48	0.75	0.49	7	5	0.58	0.38	TRUE	0.32	0.05			
	27	34	0.54	0.68	-0.22	0.69	-7	-21	-0.54	-1.69	FALSE	-0.02	0.00			
210-Pb	298	31	5.96	0.62	1.46	0.63	19	8	1.58	0.68	TRUE	0.27	0.01			
232-Th							232Th		ppm eTh	error				sum		
228-Ac	664	46	13.28	0.92	11.49	0.93	40	3	9.94	0.83	TRUE	3.60	0.09	full	38.82	1.04
	629	49	12.58	0.98	10.18	0.99	32	3	7.94	0.79	TRUE	3.17	0.10			
	847	67	16.94	1.34	10.61	1.36	44	6	10.78	1.40	TRUE	1.35	0.03			
224-Ra																
212-Pb	4078	111	81.56	2.22	67.85	2.24	36	1	8.96	0.31	TRUE	22.69	0.62			
212-Bi	225	51	4.50	1.02	3.95	1.03	45	12	11.13	2.97	TRUE	0.31	0.01			
208-Tl	201	38	4.02	0.76	2.92	0.77	52	14	12.74	3.44	TRUE	0.26	0.01			
	1146	64	22.92	1.28	19.22	1.29	42	3	10.26	0.71	TRUE	5.02	0.12			
	26	48	0.52	0.96	1.64	0.97	30	18	7.38	4.45	TRUE	0.09	0.00			
	589	33	11.78	0.66	6.51	0.68	37	4	9.24	0.99	TRUE	2.34	0.06			

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	455	14	1.47	0.05			1.22	0.0387	0.355	0.01
WM	U	11.11	0.812	0.9	0.07	2.50	0.18	0.13	0.0096	0.103	0.01
	Th	37.31	0.961	9.197	0.24	6.80	0.18	0.26	0.0068	0.473	0.01
					Total	9.30	0.25	1.62	0.0404	0.931	0.02
Thfull/Ufull				10.22							
Pre 222Rn	U	15.37	14.85	1.244	1.20	3.46	3.34	0.18	0.1758	0.143	0.14
Post 222Rn	U	10.87	0.859	0.88	0.07	2.45	0.19	0.13	0.0102	0.101	0.01
Difference		4.50	14.88	0.36	1.21	1.01	3.35	0.05	0.18	0.04	0.14

Detector	#3																
Sample	**2221**																
Filename	2221																
Roi file	G3nov07																
Date	19/12/07																
Time (ks)	25.00																
Mass (g)	100																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error		Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	1160	40	46.40	1.60	38.54	1.61	468	20	1.51	0.06							
238-U							238U		ppm eU	error			x/sigma^2	1/sigma^	sum		
234-Th	832	41	33.28	1.64	-0.13	1.65	-1	-11	-0.07	-0.89	FALSE		-0.01	0.01	full	7.31	0.69
	840	50	33.60	2.00	-5.11	2.01	-29	-12	-2.38	-0.95	FALSE		-0.22	0.01	preRn	0.00	0.04
226-Ra (23	600	41	24.00	1.64	2.66	1.65	11	7	0.92	0.58	TRUE		0.23	0.02	postRn	7.31	0.65
214-Pb																	
	176	28	7.04	1.12	3.78	1.13	9	3	0.69	0.21	TRUE		1.27	0.15			
	333	36	13.32	1.44	9.15	1.45	11	2	0.91	0.15	TRUE		3.23	0.29			
214-Bi	318	39	12.72	1.56	7.75	1.57	12	3	1.00	0.21	TRUE		1.86	0.15			
	59	19	2.36	0.76	1.35	0.77	10	6	0.82	0.47	TRUE		0.30	0.03			
	33	17	1.32	0.68	0.80	0.68	17	15	1.40	1.21	TRUE		0.08	0.00			
	84	18	3.36	0.72	1.47	0.73	14	7	1.14	0.57	TRUE		0.29	0.02			
	44	18	1.76	0.72	1.00	0.73	30	22	2.45	1.79	TRUE		0.06	0.00			
210-Pb	171	22	6.84	0.88	2.34	0.89	31	12	2.53	0.97	TRUE		0.22	0.01			
232-Th							232Th		ppm eTh	error					sum		
228-Ac	348	32	13.92	1.28	12.13	1.29	43	5	10.49	1.13	FALSE		2.02	0.05	full	18.65	0.59
	278	35	11.12	1.40	8.72	1.41	28	4	6.80	1.11	TRUE		1.37	0.05			
	334	49	13.36	1.96	7.03	1.97	29	8	7.14	2.01	TRUE		0.44	0.02			
224-Ra																	
212-Pb	1803	75	72.12	3.00	58.41	3.02	31	2	7.71	0.41	TRUE		11.46	0.37			
212-Bi	117	34	4.68	1.36	4.13	1.37	47	16	11.64	3.91	TRUE		0.19	0.00			
208-Tl	59	27	2.36	1.08	1.26	1.09	22	19	5.50	4.76	TRUE		0.06	0.00			
	416	44	16.64	1.76	12.94	1.77	28	4	6.90	0.95	TRUE		1.88	0.07			
	72	34	2.88	1.36	4.00	1.37	73	26	18.02	6.43	TRUE		0.11	0.00			
	275	23	11.00	0.92	5.73	0.93	33	5	8.13	1.34	TRUE		1.12	0.03			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamma	error
Full Series	K	468	20	1.51	0.06			1.26	0.0538	0.36493	0.02
WM	U	10.66	1.457	0.863	0.12	2.40	0.33	0.13	0.0172	0.09916	0.01
	Th	31.73	1.701	7.82	0.42	5.78	0.31	0.22	0.012	0.40197	0.02
					Total	8.18	0.45	1.61	0.0577	0.86606	0.03
Thfull/Ufull				9.06							
Pre 222Rn	U	0.10	28.29	0.008	2.29	0.02	6.37	0.00	0.3347	0.00093	0.26
Post 222Rn	U	11.23	1.537	0.909	0.12	2.53	0.35	0.13	0.0182	0.10449	0.01
Difference		-11.13	28.33	-0.90	2.29	-2.50	6.38	-0.13	0.34	-0.10	0.26

Detector	#3																
Sample	**2223.00**																
Filename	2223																
Roi file	G3nov07																
Date	19/12/07																
Time (ks)	50.00																
Mass (g)	100				Net		Specific		Concentration		Within	WM calcs					
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	4199	74	83.98	1.48	76.12	1.49	925	20	2.99	0.07							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1730	59	34.60	1.18	1.19	1.20	8	8	0.64	0.65	TRUE	0.12	0.02	full	17.45	0.95	
	1873	74	37.46	1.48	-1.25	1.50	-7	-9	-0.58	-0.70	FALSE	-0.10	0.01	preRn	0.52	0.07	
226-Ra (23	1222	59	24.44	1.18	3.10	1.20	13	5	1.08	0.42	TRUE	0.50	0.04	postRn	16.93	0.89	
214-Pb																	
	614	43	12.28	0.86	9.02	0.87	20	2	1.66	0.18	TRUE	4.11	0.20				
	944	56	18.88	1.12	14.71	1.13	18	2	1.46	0.13	TRUE	6.56	0.36				
214-Bi	860	59	17.20	1.18	12.23	1.19	19	2	1.57	0.17	TRUE	4.25	0.22				
	200	30	4.00	0.60	2.99	0.61	23	5	1.83	0.38	TRUE	1.01	0.04				
	41	28	0.82	0.56	0.30	0.57	6	12	0.52	0.99	TRUE	0.04	0.01				
	196	26	3.92	0.52	2.03	0.53	20	5	1.58	0.42	TRUE	0.73	0.04				
	30	30	0.60	0.60	-0.16	0.61	-5	-18	-0.39	-1.49	FALSE	-0.01	0.00				
210-Pb	296	32	5.92	0.64	1.42	0.65	19	9	1.53	0.70	TRUE	0.25	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	489	44	9.78	0.88	7.99	0.89	28	3	6.91	0.78	TRUE	2.79	0.10	full	28.97	1.18	
	567	48	11.34	0.96	8.94	0.97	28	3	6.98	0.77	TRUE	2.92	0.10				
	528	70	10.56	1.40	4.23	1.42	17	6	4.30	1.44	TRUE	0.51	0.03				
224-Ra																	
212-Pb	2826	106	56.52	2.12	42.81	2.14	23	1	5.65	0.29	TRUE	16.60	0.72				
212-Bi	194	50	3.88	1.00	3.33	1.01	38	12	9.39	2.90	TRUE	0.27	0.01				
208-Tl	123	38	2.46	0.76	1.36	0.77	24	14	5.94	3.38	TRUE	0.13	0.01				
	866	62	17.32	1.24	13.62	1.25	29	3	7.27	0.68	TRUE	3.88	0.13				
	97	49	1.94	0.98	3.06	0.99	56	19	13.77	4.69	TRUE	0.15	0.00				
	468	31	9.36	0.62	4.09	0.64	24	4	5.81	0.92	TRUE	1.71	0.07				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	925	20	2.99	0.07			2.48	0.0542	0.721	0.02
WM	U	18.29	1.048	1.481	0.08	4.12	0.24	0.22	0.0124	0.17	0.01
	Th	24.65	0.851	6.076	0.21	4.49	0.16	0.17	0.006	0.312	0.01
					Total	8.61	0.28	2.87	0.0559	1.203	0.02
Thfull/Ufull				4.10							
Pre 222Rn	U	7.89	15.05	0.639	1.22	1.78	3.39	0.09	0.1781	0.073	0.14
Post 222Rn	U	19.07	1.127	1.544	0.09	4.29	0.25	0.23	0.0133	0.177	0.01
Difference		-11.17	15.10	-0.90	1.22	-2.51	3.40	-0.13	0.18	-0.10	0.14

Detector	#3																
Sample	**2227.00**																
Filename	2227																
Roi file	G3nov07																
Date	20/12/07																
Time (ks)	25.00																
Mass (g)	100.00					Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error		2 err of WM ?					
							K		%K								
40-K	1637	46	65.48	1.84	57.62	1.84	700	23	2.26	0.08							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	867	41	34.68	1.64	1.27	1.65	8	11	0.69	0.90	TRUE	0.07	0.01	full	6.44	0.72	
	821	49	32.84	1.96	-5.87	1.97	-34	-11	-2.73	-0.93	FALSE	-0.26	0.01	preRn	-0.12	0.04	
226-Ra (23	552	40	22.08	1.60	0.74	1.61	3	7	0.26	0.56	TRUE	0.07	0.02	postRn	6.56	0.69	
214-Pb																	
	203	28	8.12	1.12	4.86	1.13	11	3	0.89	0.21	TRUE	1.61	0.15				
	263	35	10.52	1.40	6.35	1.41	8	2	0.63	0.14	TRUE	2.48	0.32				
214-Bi	255	39	10.20	1.56	5.23	1.57	8	3	0.67	0.20	TRUE	1.30	0.16				
	86	19	3.44	0.76	2.43	0.77	18	6	1.48	0.47	TRUE	0.53	0.03				
	25	18	1.00	0.72	0.48	0.72	10	16	0.84	1.27	TRUE	0.04	0.00				
	104	17	4.16	0.68	2.27	0.69	22	7	1.77	0.54	TRUE	0.49	0.02				
	31	19	1.24	0.76	0.48	0.77	15	23	1.18	1.88	TRUE	0.03	0.00				
210-Pb	134	21	5.36	0.84	0.86	0.85	11	11	0.93	0.92	TRUE	0.09	0.01				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	107	28	4.28	1.12	2.49	1.13	9	4	2.15	0.98	TRUE	0.56	0.06	full	10.09	0.70	
	187	32	7.48	1.28	5.08	1.29	16	4	3.96	1.01	TRUE	0.96	0.06				
	263	49	10.52	1.96	4.19	1.97	17	8	4.26	2.01	TRUE	0.26	0.02				
224-Ra																	
212-Pb	1031	70	41.24	2.80	27.53	2.82	15	2	3.64	0.37	TRUE	6.40	0.43				
212-Bi	87	35	3.48	1.40	2.93	1.41	34	16	8.26	4.00	TRUE	0.13	0.00				
208-Tl	2	25	0.08	1.00	-1.02	1.01	-18	-18	-4.45	-4.41	FALSE	-0.06	0.00				
	276	42	11.04	1.68	7.34	1.69	16	4	3.92	0.90	TRUE	1.18	0.07				
	-26	35	-1.04	1.40	0.08	1.41	1	26	0.36	6.34	TRUE	0.00	0.00				
	195	20	7.80	0.80	2.53	0.81	15	5	3.59	1.16	TRUE	0.66	0.05				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	700	23	2.26	0.08			1.88	0.0629	0.546	0.02
WM	U	8.92	1.385	0.722	0.11	2.01	0.31	0.11	0.0164	0.083	0.01
	Th	14.41	1.427	3.551	0.35	2.62	0.26	0.10	0.0101	0.183	0.02
					Total	4.63	0.41	2.09	0.0658	0.811	0.03
Thfull/Ufull				4.92							
Pre 222Rn	U	-3.26	27.24	-0.26	2.21	-0.73	6.13	-0.04	0.3223	-0.03	0.25
Post 222Rn	U	9.57	1.459	0.775	0.12	2.15	0.33	0.11	0.0173	0.089	0.01
Difference		-12.84	27.28	-1.04	2.21	-2.89	6.14	-0.15	0.32	-0.12	0.25

Detector	#2																
Sample	**2214**																
Filename	2214																
Roi file	G2oct06																
Date	16/12/07																
Time (ks)	50.00																
Mass (g)	100																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration		error	Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	4347	70	86.94	1.40	80.24	1.40	645	13	2.08	0.04							
238-U							238U		ppm eU		error		x/sigm	1/sigm	sum		
234-Th	1772	66	35.44	1.32	1.54	1.34	6	6	0.52	0.45	FALSE	0.21	0.03	full		34.72	1.61
	1314	66	26.28	1.32	4.57	1.34	16	5	1.30	0.39	TRUE	0.71	0.04	preRn		2.57	0.16
226-Ra (23	1507	64	30.14	1.28	7.95	1.30	21	4	1.67	0.29	TRUE	1.66	0.08	postRn		32.15	1.45
214-Pb																	
	866	41	17.32	0.82	14.87	0.83	27	2	2.15	0.16	FALSE	6.68	0.25				
	1434	51	28.68	1.02	23.66	1.03	20	1	1.59	0.11	TRUE	11.58	0.59				
214-Bi	1326	50	26.52	1.00	21.72	1.01	23	2	1.89	0.13	TRUE	9.14	0.39				
	250	31	5.00	0.62	3.92	0.63	21	4	1.69	0.28	TRUE	1.69	0.08				
	120	33	2.40	0.66	1.83	0.67	27	10	2.20	0.81	TRUE	0.27	0.01				
	243	25	4.86	0.50	3.22	0.51	21	3	1.66	0.27	TRUE	1.78	0.09				
	81	14	1.62	0.28	1.14	0.28	30	8	2.43	0.62	TRUE	0.51	0.02				
210-Pb	612	62	12.24	1.24	4.34	1.25	24	7	1.93	0.57	TRUE	0.49	0.02				
232-Th							232Th		ppm eTh		error				sum		
228-Ac	732	41	14.64	0.82	13.84	0.83	44	3	10.73	0.66	FALSE	6.10	0.14	full		99.47	1.65
	1666	54	33.32	1.08	31.19	1.09	66	2	16.22	0.60	FALSE	10.96	0.17				
	1351	63	27.02	1.26	23.93	1.27	66	4	16.35	0.91	TRUE	4.85	0.07				
224-Ra																	
212-Pb	9109	135	#####	2.70	#####	2.72	58	1	14.28	0.26	FALSE	50.18	0.87				
212-Bi	524	38	10.48	0.76	10.02	0.77	66	5	16.20	1.29	TRUE	2.40	0.04				
208-Tl	337	42	6.74	0.84	5.94	0.85	82	12	20.26	3.04	TRUE	0.54	0.01				
	2506	63	50.12	1.26	47.50	1.27	69	2	16.92	0.49	FALSE	17.17	0.25				
	292	28	5.84	0.56	5.48	0.57	70	8	17.26	1.86	TRUE	1.23	0.02				
	972	35	19.44	0.70	15.02	0.71	63	3	15.64	0.80	TRUE	6.03	0.10				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	645	13	2.08	0.04			1.73	0.0336	0.502	0.01
WM	U	21.63	0.623	1.752	0.05	4.87	0.14	0.26	0.0074	0.201	0.01
	Th	60.23	0.605	14.84	0.15	10.97	0.11	0.42	0.0043	0.763	0.01
					Total	15.84	0.18	2.41	0.0347	1.467	0.01
Thfull/Ufull				8.47							
Pre 222Rn	U	16.40	6.372	1.328	0.52	3.69	1.43	0.19	0.0754	0.153	0.06
Post 222Rn	U	22.20	0.691	1.798	0.06	5.00	0.16	0.26	0.0082	0.207	0.01
Difference		-5.80	6.41	-0.47	0.52	-1.31	1.44	-0.07	0.08	-0.05	0.06

Detector	#2																
Sample	**2217**																
Filename	2217																
Roi file	G2oct06																
Date	18/12/07																
Time (ks)	25.00																
Mass (g)	100.00																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration		error	Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	1928	47	77.12	1.88	70.42	1.88	566	16	1.83	0.05							
238-U							238U		ppm eU		error		x/sigm	1/sigm	sum		
234-Th	926	47	37.04	1.88	3.14	1.89	13	8	1.05	0.64	TRUE		0.21	0.02	full	21.74	1.38
	803	48	32.12	1.92	10.41	1.93	37	7	2.97	0.57	FALSE		0.74	0.02	preRn	1.71	0.08
226-Ra (23	716	44	28.64	1.76	6.45	1.77	17	5	1.35	0.38	TRUE		0.76	0.05	postRn	20.02	1.30
214-Pb																	
	319	27	12.76	1.08	10.31	1.09	18	2	1.49	0.17	TRUE		3.98	0.22			
	595	33	23.80	1.32	18.78	1.33	16	1	1.26	0.11	TRUE		8.56	0.55			
214-Bi	459	32	18.36	1.28	13.56	1.29	15	2	1.18	0.13	TRUE		5.94	0.41			
	96	21	3.84	0.84	2.76	0.85	15	5	1.19	0.37	TRUE		0.71	0.05			
	17	23	0.68	0.92	0.11	0.92	2	14	0.14	1.11	TRUE		0.01	0.01			
	83	17	3.32	0.68	1.68	0.68	11	4	0.87	0.36	TRUE		0.55	0.05			
	27	11	1.08	0.44	0.60	0.44	16	12	1.27	0.95	TRUE		0.12	0.01			
210-Pb	260	43	10.40	1.72	2.50	1.73	14	10	1.11	0.77	TRUE		0.15	0.01			
232-Th							232Th		ppm eTh		error				sum		
228-Ac	430	30	17.20	1.20	16.40	1.20	52	4	12.72	0.95	FALSE		3.47	0.07	full	56.78	0.84
	924	40	36.96	1.60	34.83	1.61	73	4	18.11	0.87	TRUE		5.93	0.08			
	742	47	29.68	1.88	26.59	1.89	74	5	18.17	1.33	TRUE		2.55	0.03			
224-Ra																	
212-Pb	5191	99	#####	3.96	#####	3.97	66	1	16.39	0.37	TRUE		30.24	0.45			
212-Bi	244	28	9.76	1.12	9.30	1.12	61	8	15.03	1.85	TRUE		1.08	0.02			
208-Tl	119	30	4.76	1.20	3.96	1.21	55	17	13.51	4.16	TRUE		0.19	0.00			
	1326	47	53.04	1.88	50.42	1.89	73	3	17.97	0.70	TRUE		8.94	0.12			
	145	19	5.80	0.76	5.44	0.76	70	10	17.13	2.46	TRUE		0.70	0.01			
	589	26	23.56	1.04	19.14	1.05	81	5	19.93	1.16	FALSE		3.68	0.05			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	566	16	1.83	0.05			1.52	0.0426	0.441	0.01
WM	U	15.77	0.725	1.277	0.06	3.55	0.16	0.19	0.0086	0.147	0.01
	Th	67.85	1.195	16.72	0.29	12.36	0.22	0.48	0.0084	0.86	0.02
					Total	15.91	0.27	2.18	0.0442	1.447	0.02
Thfull/Ufull				13.10							
Pre 222Rn	U	20.87	12.19	1.69	0.99	4.70	2.74	0.25	0.1442	0.194	0.11
Post 222Rn	U	15.44	0.771	1.251	0.06	3.48	0.17	0.18	0.0091	0.144	0.01
Difference		5.43	12.21	0.44	0.99	1.22	2.75	0.06	0.14	0.05	0.11

Detector	#2																
Sample	**2218**																
Filename	2218																
Roi file	G2oct06																
Date	18/12/07																
Time (ks)	50.00																
Mass (g)	100.00																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration	error	Within 2 err of WM ?	WM calcs					
							K		%K								
40-K	1234	42	24.68	0.84	17.98	0.85	144	7	0.47	0.02							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1789	60	35.78	1.20	1.88	1.22	8	5	0.63	0.41	TRUE	0.30	0.04	full		29.01	4.03
	1371	61	27.42	1.22	5.71	1.24	20	4	1.63	0.36	FALSE	1.00	0.05	preRn		2.21	0.20
226-Ra (23	1270	57	25.40	1.14	3.21	1.16	8	3	0.67	0.25	TRUE	0.90	0.11	postRn		26.80	3.83
214-Pb																	
	370	32	7.40	0.64	4.95	0.65	9	1	0.72	0.10	TRUE	5.73	0.65				
	706	40	14.12	0.80	9.10	0.81	8	1	0.61	0.06	TRUE	12.70	1.68				
214-Bi	511	40	10.22	0.80	5.42	0.81	6	1	0.47	0.07	TRUE	6.88	1.18				
	74	26	1.48	0.52	0.40	0.53	2	3	0.17	0.23	TRUE	0.27	0.13				
	83	26	1.66	0.52	1.09	0.53	16	8	1.32	0.64	TRUE	0.26	0.02				
	114	22	2.28	0.44	0.64	0.45	4	3	0.33	0.23	TRUE	0.50	0.12				
	36	11	0.72	0.22	0.24	0.22	6	6	0.50	0.48	TRUE	0.18	0.03				
210-Pb	488	54	9.76	1.08	1.86	1.10	10	6	0.82	0.49	TRUE	0.28	0.03				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	684	37	13.68	0.74	12.88	0.75	41	2	9.99	0.60	TRUE	6.93	0.17	full		93.99	2.40
	1039	47	20.78	0.94	18.65	0.95	39	2	9.70	0.51	TRUE	9.21	0.23				
	894	56	17.88	1.12	14.79	1.14	41	3	10.11	0.79	TRUE	3.96	0.10				
224-Ra																	
212-Pb	5971	117	#####	2.34	#####	2.36	37	1	9.11	0.21	FALSE	48.76	1.32				
212-Bi	358	33	7.16	0.66	6.70	0.67	44	4	10.83	1.11	TRUE	2.18	0.05				
208-Tl	173	37	3.46	0.74	2.66	0.75	37	11	9.08	2.59	TRUE	0.33	0.01				
	1632	54	32.64	1.08	30.02	1.09	43	2	10.70	0.41	FALSE	15.87	0.37				
	165	24	3.30	0.48	2.94	0.49	38	6	9.26	1.56	TRUE	0.94	0.03				
	767	31	15.34	0.62	10.92	0.63	46	3	11.37	0.69	FALSE	5.80	0.13				

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	144	7	0.47	0.02			0.39	0.0186	0.113	0.01
WM	U	7.20	0.248	0.583	0.02	1.62	0.06	0.09	0.0029	0.067	0.00
	Th	39.22	0.417	9.666	0.10	7.14	0.08	0.28	0.0029	0.497	0.01
					Total	8.76	0.09	0.75	0.019	0.676	0.01
Thfull/Ufull				16.57							
Pre 222Rn	U	11.19	5.065	0.906	0.41	2.52	1.14	0.13	0.0599	0.104	0.05
Post 222Rn	U	7.00	0.261	0.567	0.02	1.57	0.06	0.08	0.0031	0.065	0.00
Difference		4.19	5.07	0.34	0.41	0.94	1.14	0.05	0.06	0.04	0.05

Detector	#2																
Sample	**2220**																
Filename	2220																
Roi file	G2oct06																
Date	19/12/07																
Time (ks)	25.00																
Mass (g)	100.00																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error			Concentration error		Within 2 err of WM ?	WM calcs			
							K		%K								
40-K	1237	38	49.48	1.52	42.78	1.52	344	13	1.11	0.04							
238-U							238U		ppm eU	error				x/sigm	1/sigm	sum	
234-Th	788	40	31.52	1.60	-2.38	1.61	-10	-7	-0.80	-0.54	FALSE			-0.22	0.02	full	15.76 2.36
	409	39	16.36	1.56	-5.35	1.57	-19	-6	-1.52	-0.46	FALSE			-0.60	0.03	preRn	-0.57 0.11
226-Ra (23	594	39	23.76	1.56	1.57	1.57	4	4	0.33	0.33	TRUE			0.24	0.06	postRn	16.33 2.25
214-Pb																	
	230	23	9.20	0.92	6.75	0.93	12	2	0.98	0.14	FALSE			3.88	0.32		
	318	27	12.72	1.08	7.70	1.09	6	1	0.52	0.08	TRUE			6.98	1.09		
214-Bi	262	27	10.48	1.08	5.68	1.09	6	1	0.50	0.10	TRUE			4.17	0.68		
	74	20	2.96	0.80	1.88	0.81	10	4	0.81	0.35	TRUE			0.54	0.05		
	90	20	3.60	0.80	3.03	0.81	45	12	3.65	0.99	FALSE			0.30	0.01		
	62	15	2.48	0.60	0.84	0.61	5	4	0.43	0.31	TRUE			0.36	0.07		
	26	8	1.04	0.32	0.56	0.32	15	9	1.19	0.69	TRUE			0.20	0.01		
210-Pb	171	37	6.84	1.48	-1.06	1.49	-6	-8	-0.47	-0.66	FALSE			-0.09	0.01		
232-Th							232Th		ppm eTh	error						sum	
228-Ac	156	21	6.24	0.84	5.44	0.84	17	3	4.22	0.66	TRUE			2.40	0.14	full	36.86 1.83
	320	29	12.80	1.16	10.67	1.17	23	2	5.55	0.61	TRUE			3.66	0.16		
	236	37	9.44	1.48	6.35	1.49	18	4	4.34	1.02	TRUE			1.02	0.06		
224-Ra																	
212-Pb	1656	71	66.24	2.84	57.21	2.86	19	1	4.72	0.24	TRUE			20.14	1.05		
212-Bi	99	21	3.96	0.84	3.50	0.85	23	6	5.65	1.37	TRUE			0.74	0.03		
208-Tl	81	26	3.24	1.04	2.44	1.05	34	15	8.33	3.59	TRUE			0.16	0.00		
	467	33	18.68	1.32	16.06	1.33	23	2	5.72	0.48	TRUE			6.18	0.27		
	34	16	1.36	0.64	1.00	0.65	13	8	3.15	2.03	TRUE			0.19	0.01		
	247	18	9.88	0.72	5.46	0.73	23	3	5.68	0.77	TRUE			2.36	0.10		

Sample		Specific Activi (Bq/kg)		Concentration (% or ppm)		Dose Rates (mGy/a) Alpha	error	Beta	error	Gamm	error
Full Series	K	344	13	1.11	0.04			0.92	0.0338	0.268	0.01
WM	U	6.66	0.423	0.54	0.03	1.50	0.10	0.08	0.005	0.062	0.00
	Th	20.11	0.545	4.956	0.13	3.66	0.10	0.14	0.0038	0.255	0.01
					Total	5.16	0.14	1.14	0.0344	0.585	0.01
Thfull/Ufull				9.18							
Pre 222Rn	U	-5.03	8.793	-0.41	0.71	-1.13	1.98	-0.06	0.104	-0.05	0.08
Post 222Rn	U	7.25	0.444	0.587	0.04	1.63	0.10	0.09	0.0053	0.068	0.00
Difference		-12.29	8.80	-0.99	0.71	-2.76	1.98	-0.15	0.10	-0.11	0.08

Detector	#2																
Sample	**2222**																
Filename	2222																
Roi file	G2oct06																
Date	19/12/07																
Time (ks)	50.00																
Mass (g)	100.00					Net		Specific		Concentration		Within	WM calcs				
	Counts	error	Rate (cts/ks)	error	Rate (cts/ks)	error	Activity (Bq/kg)	error		error	2 err of WM ?						
							K		%K								
40-K	5376	77	#####	1.54	#####	1.54	810	14	2.62	0.05							
238-U							238U		ppm eU	error		x/sigm	1/sigm	sum			
234-Th	1700	61	34.00	1.22	0.10	1.24	0	5	0.03	0.42	FALSE	0.02	0.04	full		34.57	2.13
	894	58	17.88	1.16	-3.83	1.18	-13	-4	-1.09	-0.34	FALSE	-0.76	0.06	preRn		0.78	0.19
226-Ra (23	1423	60	28.46	1.20	6.27	1.22	16	3	1.32	0.26	TRUE	1.52	0.09	postRn		33.79	1.94
214-Pb																	
	731	38	14.62	0.76	12.17	0.77	22	2	1.76	0.14	FALSE	7.05	0.32				
	1197	47	23.94	0.94	18.92	0.95	16	1	1.27	0.09	TRUE	12.68	0.81				
214-Bi	1029	46	20.58	0.92	15.78	0.93	17	1	1.38	0.11	TRUE	9.83	0.58				
	239	32	4.78	0.64	3.70	0.65	20	4	1.59	0.29	TRUE	1.53	0.08				
	125	33	2.50	0.66	1.93	0.67	29	10	2.33	0.81	TRUE	0.28	0.01				
	219	24	4.38	0.48	2.74	0.49	17	3	1.41	0.26	TRUE	1.68	0.10				
	55	13	1.10	0.26	0.62	0.26	16	7	1.32	0.57	TRUE	0.33	0.02				
210-Pb	553	58	11.06	1.16	3.16	1.17	17	7	1.40	0.53	TRUE	0.41	0.02				
232-Th							232Th		ppm eTh	error				sum			
228-Ac	334	31	6.68	0.62	5.88	0.63	19	2	4.56	0.49	FALSE	4.68	0.25	full		72.66	3.07
	716	45	14.32	0.90	12.19	0.91	26	2	6.34	0.48	TRUE	6.78	0.26				
	607	57	12.14	1.14	9.05	1.15	25	3	6.18	0.80	TRUE	2.41	0.10				
224-Ra																	
212-Pb	3920	108	78.40	2.16	69.37	2.18	23	1	5.72	0.19	TRUE	39.58	1.70				
212-Bi	185	32	3.70	0.64	3.24	0.65	21	4	5.23	1.05	TRUE	1.16	0.05				
208-Tl	174	37	3.48	0.74	2.68	0.75	37	11	9.15	2.59	TRUE	0.34	0.01				
	1065	49	21.30	0.98	18.68	0.99	27	1	6.66	0.36	FALSE	12.58	0.47				
	112	25	2.24	0.50	1.88	0.51	24	7	5.92	1.61	TRUE	0.57	0.02				
	490	25	9.80	0.50	5.38	0.52	23	2	5.60	0.55	TRUE	4.58	0.20				

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	810	14	2.62	0.05			2.17	0.038	0.631	0.01
WM	U	16.25	0.47	1.316	0.04	3.66	0.11	0.19	0.0056	0.151	0.00
	Th	23.66	0.326	5.831	0.08	4.31	0.06	0.17	0.0023	0.3	0.00
					Total	7.97	0.12	2.53	0.0385	1.082	0.01
Thfull/Ufull				4.43							
Pre 222Rn	U	4.13	5.309	0.334	0.43	0.93	1.19	0.05	0.0628	0.038	0.05
Post 222Rn	U	17.43	0.516	1.412	0.04	3.92	0.12	0.21	0.0061	0.162	0.00
Difference		-13.30	5.33	-1.08	0.43	-2.99	1.20	-0.16	0.06	-0.12	0.05

Detector	#2																
Sample	**2226**																
Filename	2226																
Roi file	G2oct06																
Date	20/12/07																
Time (ks)	25.00																
Mass (g)	100.00																
	Counts	error	Rate (cts/ks)	error	Net Rate (cts/ks)	error	Specific Activity (Bq/kg)	error	Concentration		error	Within 2 err of WM ?	WM calcs				
							K		%K								
40-K	2702	55	#####	2.20	#####	2.20	814	19	2.63	0.06							
238-U							238U		ppm eU		error		x/sigm	1/sigm	sum		
234-Th	840	43	33.60	1.72	-0.30	1.73	-1	-7	-0.10	-0.58	FALSE		-0.02	0.02	full	20.97	1.52
	443	40	17.72	1.60	-3.99	1.61	-14	-6	-1.14	-0.46	FALSE		-0.43	0.03	preRn	0.21	0.10
226-Ra (23	675	41	27.00	1.64	4.81	1.65	12	4	1.01	0.35	TRUE		0.66	0.05	postRn	20.76	1.42
214-Pb																	
	333	26	13.32	1.04	10.87	1.05	19	2	1.57	0.17	FALSE		4.36	0.22			
	519	32	20.76	1.28	15.74	1.29	13	1	1.06	0.10	TRUE		8.34	0.64			
214-Bi	457	31	18.28	1.24	13.48	1.25	15	2	1.18	0.12	TRUE		6.22	0.43			
	76	22	3.04	0.88	1.96	0.89	10	5	0.84	0.38	TRUE		0.46	0.04			
	38	24	1.52	0.96	0.95	0.96	14	14	1.15	1.16	TRUE		0.07	0.00			
	110	17	4.40	0.68	2.76	0.68	18	4	1.42	0.36	TRUE		0.89	0.05			
	24	8	0.96	0.32	0.48	0.32	13	9	1.02	0.69	TRUE		0.17	0.01			
210-Pb	293	41	11.72	1.64	3.82	1.65	21	9	1.69	0.74	TRUE		0.25	0.01			
232-Th							232Th		ppm eTh		error				sum		
228-Ac	128	21	5.12	0.84	4.32	0.84	14	3	3.35	0.66	FALSE		1.92	0.14	full	34.73	1.73
	323	30	12.92	1.20	10.79	1.21	23	3	5.61	0.63	TRUE		3.46	0.15			
	311	40	12.44	1.60	9.35	1.61	26	4	6.39	1.11	TRUE		1.29	0.05			
224-Ra																	
212-Pb	1668	73	66.72	2.92	57.69	2.94	19	1	4.76	0.25	TRUE		19.25	1.00			
212-Bi	85	23	3.40	0.92	2.94	0.93	19	6	4.75	1.50	TRUE		0.52	0.03			
208-Tl	44	26	1.76	1.04	0.96	1.05	13	15	3.28	3.58	TRUE		0.06	0.00			
	471	34	18.84	1.36	16.22	1.37	23	2	5.78	0.49	TRUE		5.89	0.25			
	67	17	2.68	0.68	2.32	0.68	30	9	7.31	2.17	TRUE		0.38	0.01			
	235	19	9.40	0.76	4.98	0.77	21	3	5.18	0.81	TRUE		1.95	0.09			

Sample		Specific Activi		Concentration		Dose Rates (mGy/a)					
		(Bq/kg)		(% or ppm)		Alpha	error	Beta	error	Gamm	error
Full Series	K	814	19	2.63	0.06			2.19	0.0509	0.635	0.01
WM	U	13.79	0.658	1.117	0.05	3.10	0.15	0.16	0.0078	0.128	0.01
	Th	20.09	0.579	4.953	0.14	3.66	0.11	0.14	0.0041	0.255	0.01
					Total	6.76	0.18	2.49	0.0517	1.018	0.02
Thfull/Ufull				4.43							
Pre 222Rn	U	2.04	9.695	0.165	0.79	0.46	2.18	0.02	0.1147	0.019	0.09
Post 222Rn	U	14.65	0.706	1.186	0.06	3.30	0.16	0.17	0.0083	0.136	0.01
Difference		-12.61	9.72	-1.02	0.79	-2.84	2.19	-0.15	0.12	-0.12	0.09

C.3. Field Gamma Spectrometry

File	:	e:\rainbow\z021t1.chn				
Live	time	(s)	3598.48			
Energy	calibration	coefficients				
	b1=	-21.35479				
	b2=	3.096774				
	b3=	0				
E	=	450	keV	in	Ch	152
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	391945	108.9196		
E>450	keV	:	61711	17.14919		
E>1350	keV	:	11172	3.104644		
Energy	integral	:	1.10E+08	keV		
Energy	deposition	rate	:	30484.99	keV/s	
Mean	energy	per	photon	detected	:	279.8853
Dose	Rate	(mGy/a)	-	>450	0.334409	1.72E-02
Dose	Rate	(mGy/a)	-	>1350	0.330645	1.58E-02
Dose	rate	(mGy/a)	-	energy	0.46764	2.35E-02

File	:	e:\rainbow\z021b4.chn				
Live	time	(s)	3597.58			
Energy	calibration	coefficients				
	b1=	-26.12733				
	b2=	3.055703				
	b3=	0				
E	=	450	keV	in	Ch	155
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	621814	172.8423		
E>450	keV	:	99800	27.74087		
E>1350	keV	:	17845	4.960279		
Energy	integral	:	1.74E+08	keV		
Energy	deposition	rate	:	48499.63	keV/s	
Mean	energy	per	photon	detected	:	280.6005
Dose	Rate	(mGy/a)	-	>450	0.540947	2.78E-02
Dose	Rate	(mGy/a)	-	>1350	0.52827	2.51E-02
Dose	rate	(mGy/a)	-	energy	0.743984	3.73E-02

File	:	e:\rainbow\z021b3.chn				
Live	time	(s)	3597.56			
Energy	calibration	coefficients				
	b1=	-38.99734				
	b2=	3.09484				
	b3=	0				
E	=	450	keV	in	Ch	158
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	624505	173.5913		
E>450	keV	:	96659	26.86793		
E>1350	keV	:	18117	5.035913		
Energy	integral	:	1.68E+08	keV		
Energy	deposition	rate	:	46710.33	keV/s	
Mean	energy	per	photon	detected	:	269.0822
Dose	Rate	(mGy/a)	-	>450	0.523925	2.69E-02
Dose	Rate	(mGy/a)	-	>1350	0.536325	2.55E-02
Dose	rate	(mGy/a)	-	energy	0.716536	3.60E-02

File	:	e:\rainbow\z021b2.chn				
Live	time	(s)	3597.7			
Energy	calibration	coefficients				
	b1=	-38.99734				
	b2=	3.088472				
	b3=	0				
E	=	450	keV	in	Ch	158
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	592100	164.5774		
E>450	keV	:	91321	25.38316		
E>1350	keV	:	16853	4.684382		
Energy	integral	:	1.58E+08	keV		
Energy	deposition	rate	:	43963.25	keV/s	
Mean	energy	per	photon	detected	:	267.1281
Dose	Rate	(mGy/a)	-	>450	0.494972	2.54E-02
Dose	Rate	(mGy/a)	-	>1350	0.498887	2.37E-02
Dose	rate	(mGy/a)	-	energy	0.674396	3.39E-02

File	:	e:\rainbow\z021b1.chn				
Live	time	(s)	3597.68			
Energy	calibration	coefficients				
	b1=	-33.74189				
	b2=	3.096774				
	b3=	0				
E	=	450	keV	in	Ch	156
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	595723	165.5853		
E>450	keV	:	93813	26.07597		
E>1350	keV	:	17238	4.791421		
Energy	integral	:	1.63E+08	keV		
Energy	deposition	rate	:	45369.92	keV/s	
Mean	energy	per	photon	detected	:	273.9973
Dose	Rate	(mGy/a)	-	>450	0.508481	2.61E-02
Dose	Rate	(mGy/a)	-	>1350	0.510286	2.43E-02
Dose	rate	(mGy/a)	-	energy	0.695975	3.49E-02

File	:	e:\rainbow\f1022.chn				
Live	time	(s)	3597.6			
Energy	calibration	coefficients				
	b1=	-20.01592				
	b2=	3.055703				
	b3=	0				
E	=	450	keV	in	Ch	153
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	612556	170.268		
E>450	keV	:	100563	27.9528		
E>1350	keV	:	18150	5.04503		
Energy	integral	:	1.77E+08	keV		
Energy	deposition	rate	:	49130.97	keV/s	
Mean	energy	per	photon	detected	:	288.5509
Dose	Rate	(mGy/a)	-	>450	0.54508	0.028006
Dose	Rate	(mGy/a)	-	>1350	0.537296	2.55E-02
Dose	rate	(mGy/a)	-	energy	0.753669	3.78E-02

File	:	e:\rainbow\f1021.chn				
Live	time	(s)	3597.04			
Energy	calibration	coefficients				
	b1=	-43.73912				
	b2=	3.130435				
	b3=	0				
E	=	450	keV	in	Ch	157
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	755780	210.1116		
E>450	keV	:	120485	33.4956		
E>1350	keV	:	22647	6.29601		
Energy	integral	:	2.06E+08	keV		
Energy	deposition	rate	:	57275.46	keV/s	
Mean	energy	per	photon	detected	:	272.5953
Dose	Rate	(mGy/a)	-	>450	0.653164	3.35E-02
Dose	Rate	(mGy/a)	-	>1350	0.670525	3.18E-02
Dose	rate	(mGy/a)	-	energy	0.878606	4.41E-02

File	:	e:\rainbow\f1011.chn				
Live	time	(s)	3598.1			
Energy	calibration	coefficients				
	b1=	-39.93544				
	b2=	3.096774				
	b3=	0				
E	=	450	keV	in	Ch	158
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	485689	134.9848		
E>450	keV	:	78507	21.81901		
E>1350	keV	:	14911	4.144132		
Energy	integral	:	1.34E+08	keV		
Energy	deposition	rate	:	37191.18	keV/s	
Mean	energy	per	photon	detected	:	275.5212
Dose	Rate	(mGy/a)	-	>450	0.425471	2.19E-02
Dose	Rate	(mGy/a)	-	>1350	0.44135	2.10E-02
Dose	rate	(mGy/a)	-	energy	0.570513	2.86E-02

File	:	e:\rainbow\e4002.chn				
Live	time	(s)	3596.76			
Energy	calibration	coefficients				
	b1=	-24.04873				
	b2=	3.121951				
	b3=	0				
E	=	450	keV	in	Ch	151
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	835931	232.4122		
E>450	keV	:	132498	36.83815		
E>1350	keV	:	24045	6.685183		
Energy	integral	:	2.34E+08	keV		
Energy	deposition	rate	:	65073.31	keV/s	
Mean	energy	per	photon	detected	:	279.9909
Dose	Rate	(mGy/a)	-	>450	0.718344	3.69E-02
Dose	Rate	(mGy/a)	-	>1350	0.711972	3.37E-02
Dose	rate	(mGy/a)	-	energy	0.998225	5.01E-02

File	:	e:\rainbow\e4001.chn				
Live	time	(s)	3596.78			
Energy	calibration	coefficients				
	b1=	-36.51182				
	b2=	3.039578				
	b3=	0				
E	=	450	keV	in	Ch	160
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	829823	230.7127		
E>450	keV	:	124850	34.7116		
E>1350	keV	:	23850	6.630931		
Energy	integral	:	2.21E+08	keV		
Energy	deposition	rate	:	61506.16	keV/s	
Mean	energy	per	photon	detected	:	266.5919
Dose	Rate	(mGy/a)	-	>450	0.676876	3.48E-02
Dose	Rate	(mGy/a)	-	>1350	0.706194	3.35E-02
Dose	rate	(mGy/a)	-	energy	0.943505	4.74E-02

File	:	e:\rainbow\c018c2.chn				
Live	time	(s)	3596.3			
Energy	calibration	coefficients				
	b1=	-35.59998				
	b2=	3.113513				
	b3=	0				
E	=	450	keV	in	Ch	155
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	944922	262.7484		
E>450	keV	:	159721	44.41259		
E>1350	keV	:	29881	8.308817		
Energy	integral	:	2.69E+08	keV		
Energy	deposition	rate	:	74833.15	keV/s	
Mean	energy	per	photon	detected	:	284.8092
Dose	Rate	(mGy/a)	-	>450	0.866046	4.45E-02
Dose	Rate	(mGy/a)	-	>1350	0.884889	4.19E-02
Dose	rate	(mGy/a)	-	energy	1.147941	5.76E-02

File	:	e:\rainbow\c018c1.chn				
Live	time	(s)	3595.86			
Energy	calibration	coefficients				
	b1=	-47.40716				
	b2=	3.191136				
	b3=	0				
E	=	450	keV	in	Ch	155
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1062796	295.561		
E>450	keV	:	174923	48.64566		
E>1350	keV	:	33529	9.324334		
Energy	integral	:	2.92E+08	keV		
Energy	deposition	rate	:	81218.63	keV/s	
Mean	energy	per	photon	detected	:	274.7948
Dose	Rate	(mGy/a)	-	>450	0.948591	4.87E-02
Dose	Rate	(mGy/a)	-	>1350	0.993042	4.69E-02
Dose	rate	(mGy/a)	-	energy	1.245894	6.25E-02

File	:	e:\rainbow\c009t2.chn				
Live	time	(s)	3596.44			
Energy	calibration	coefficients				
	b1=	-53.46518				
	b2=	3.080214				
	b3=	0				
E	=	450	keV	in	Ch	163
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	911267	253.3803		
E>450	keV	:	141965	39.47376		
E>1350	keV	:	27198	7.562479		
Energy	integral	:	2.38E+08	keV		
Energy	deposition	rate	:	66242.33	keV/s	
Mean	energy	per	photon	detected	:	261.4344
Dose	Rate	(mGy/a)	-	>450	0.769738	3.95E-02
Dose	Rate	(mGy/a)	-	>1350	0.805404	3.81E-02
Dose	rate	(mGy/a)	-	energy	1.016157	5.10E-02

File	:	e:\rainbow\c009t1.chn				
Live	time	(s)	3596.92			
Energy	calibration	coefficients				
	b1=	-41.56407				
	b2=	3.138965				
	b3=	0				
E	=	450	keV	in	Ch	156
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	788500	219.2153		
E>450	keV	:	125902	35.00273		
E>1350	keV	:	24028	6.68016		
Energy	integral	:	2.14E+08	keV		
Energy	deposition	rate	:	59621.97	keV/s	
Mean	energy	per	photon	detected	:	271.979
Dose	Rate	(mGy/a)	-	>450	0.682553	3.51E-02
Dose	Rate	(mGy/a)	-	>1350	0.711437	3.37E-02
Dose	rate	(mGy/a)	-	energy	0.914601	4.59E-02

File	:	e:\rainbow\c009b2.chn				
Live	time	(s)	3596.72			
Energy	calibration	coefficients				
	b1=	-40.20801				
	b2=	3.072				
	b3=	0				
E	=	450	keV	in	Ch	159
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	838448	233.1146		
E>450	keV	:	128255	35.65888		
E>1350	keV	:	24049	6.68637		
Energy	integral	:	2.24E+08	keV		
Energy	deposition	rate	:	62288.89	keV/s	
Mean	energy	per	photon	detected	:	267.2029
Dose	Rate	(mGy/a)	-	>450	0.695348	0.035712
Dose	Rate	(mGy/a)	-	>1350	0.712098	3.37E-02
Dose	rate	(mGy/a)	-	energy	0.955512	4.80E-02

File	:	e:\rainbow\c009b1.chn				
Live	time	(s)	3596.58			
Energy	calibration	coefficients				
	b1=	-42.08581				
	b2=	3.088472				
	b3=	0				
E	=	450	keV	in	Ch	159
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	875135	243.3242		
E>450	keV	:	135981	37.80842		
E>1350	keV	:	25604	7.118985		
Energy	integral	:	2.35E+08	keV		
Energy	deposition	rate	:	65203.69	keV/s	
Mean	energy	per	photon	detected	:	267.9704
Dose	Rate	(mGy/a)	-	>450	0.737264	3.79E-02
Dose	Rate	(mGy/a)	-	>1350	0.758172	0.035909
Dose	rate	(mGy/a)	-	energy	1.000225	5.02E-02

File	:	e:\rainbow\green3.chn				
Live	time	(s)	3595.62			
Energy	calibration	coefficients				
	b1=	-17				
	b2=	3				
	b3=	0				
E	=	450	keV	in	Ch	155
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1184973	329.5601		
E>450	keV	:	190580	53.00337		
E>1350	keV	:	32772	9.114422		
Energy	integral	:	3.40E+08	keV		
Energy	deposition	rate	:	94445.07	keV/s	
Mean	energy	per	photon	detected	:	286.5792
Dose	Rate	(mGy/a)	-	>450	1.033566	5.31E-02
Dose	Rate	(mGy/a)	-	>1350	0.970686	4.59E-02
Dose	rate	(mGy/a)	-	energy	1.448787	7.27E-02

File	:	e:\rainbow\green2.chn				
Live	time	(s)	3595.64			
Energy	calibration	coefficients				
	b1=	-31.66928				
	b2=	3.023622				
	b3=	0				
E	=	450	keV	in	Ch	159
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1184678	329.4763		
E>450	keV	:	177520	49.37091		
E>1350	keV	:	31160	8.666051		
Energy	integral	:	3.17E+08	keV		
Energy	deposition	rate	:	88297.86	keV/s	
Mean	energy	per	photon	detected	:	267.9946
Dose	Rate	(mGy/a)	-	>450	0.962733	4.94E-02
Dose	Rate	(mGy/a)	-	>1350	0.922934	4.36E-02
Dose	rate	(mGy/a)	-	energy	1.354489	6.80E-02

File	:	e:\rainbow\co1.chn				
Live	time	(s)	3597.18			
Energy	calibration	coefficients				
	b1=	-24.35351				
	b2=	3.039578				
	b3=					
E	=	450	keV	in	Ch	156
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	726725	202.0263		
E>450	keV	:	112096	31.16219		
E>1350	keV	:	20657	5.742554		
Energy	integral	:	2E+08	keV		
Energy	deposition	rate	:	55593.38	keV/s	
Mean	energy	per	photon	detected	:	275.1789
Dose	Rate	(mGy/a)	-	>450	0.607663	0.031215
Dose	Rate	(mGy/a)	-	>1350	0.611582	0.029026
Dose	rate	(mGy/a)	-	energy	0.852802	0.042807

File	:	e:\rainbow\co2.chn				
Live	time	(s)	3597.34			
Energy	calibration	coefficients				
	b1=	-14.846				
	b2=	3.007833				
	b3=					
E	=	450	keV	in	Ch	154
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	681068	189.3254		
E>450	keV	:	108338	30.11614		
E>1350	keV	:	19143	5.321432		
Energy	integral	:	1.93E+08	keV		
Energy	deposition	rate	:	53639.93	keV/s	
Mean	energy	per	photon	detected	:	283.3213
Dose	Rate	(mGy/a)	-	>450	0.587265	0.030169
Dose	Rate	(mGy/a)	-	>1350	0.566733	0.026921
Dose	rate	(mGy/a)	-	energy	0.822837	0.041303

File	:	e:\rainbow\co3.chn				
Live	time	(s)	3597.28			
Energy	calibration	coefficients				
	b1=	-33.14899				
	b2=	3.06383				
	b3=					
E	=	450	keV	in	Ch	157
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	696436	193.6007		
E>450	keV	:	115884	32.21434		
E>1350	keV	:	20652	5.741004		
Energy	integral	:	1.94E+08	keV		
Energy	deposition	rate	:	54014	keV/s	
Mean	energy	per	photon	detected	:	278.9969
Dose	Rate	(mGy/a)	-	>450	0.62818	0.032267
Dose	Rate	(mGy/a)	-	>1350	0.611417	0.029019
Dose	rate	(mGy/a)	-	energy	0.828575	0.041591

File	:	e:\rainbow\do1.chn				
Live	time	(s)	3592.76			
Energy	calibration	coefficients				
	b1=	-45.17428				
	b2=	3.088472				
	b3=					
E	=	450	keV	in	Ch	160
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1861425	518.1045		
E>450	keV	:	283935	79.02977		
E>1350	keV	:	55377	15.4135		
Energy	integral	:	4.92E+08	keV		
Energy	deposition	rate	:	136928.4	keV/s	
Mean	energy	per	photon	detected	:	264.2873
Dose	Rate	(mGy/a)	-	>450	1.541081	0.079083
Dose	Rate	(mGy/a)	-	>1350	1.641538	0.077383
Dose	rate	(mGy/a)	-	energy	2.100482	0.105435

File	:	e:\rainbow\do2.chn				
Live	time	(s)	3594.06			
Energy	calibration	coefficients				
	b1=	-12.68061				
	b2=	3.015707				
	b3=					
E	=	450	keV	in	Ch	153
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1522434	423.5973		
E>450	keV	:	236932	65.92322		
E>1350	keV	:	43077	11.98561		
Energy	integral	:	4.38E+08	keV		
Energy	deposition	rate	:	121738.7	keV/s	
Mean	energy	per	photon	detected	:	287.3924
Dose	Rate	(mGy/a)	-	>450	1.285503	0.065976
Dose	Rate	(mGy/a)	-	>1350	1.276467	0.060243
Dose	rate	(mGy/a)	-	energy	1.867471	0.093739

File	:	e:\rainbow\do3.chn				
Live	time	(s)	3594.72			
Energy	calibration	coefficients				
	b1=	-30.08516				
	b2=	3.06383				
	b3=					
E	=	450	keV	in	Ch	156
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1361482	378.7449		
E>450	keV	:	188196	52.35345		
E>1350	keV	:	34621	9.63107		
Energy	integral	:	3.52E+08	keV		
Energy	deposition	rate	:	97892.95	keV/s	
Mean	energy	per	photon	detected	:	258.4667
Dose	Rate	(mGy/a)	-	>450	1.020892	0.052406
Dose	Rate	(mGy/a)	-	>1350	1.025709	0.04847
Dose	rate	(mGy/a)	-	energy	1.501678	0.075378

File	:	e:\rainbow\fo1a.chn				
Live	time	(s)	3594.42			
Energy	calibration	coefficients				
	b1=	-42.34048				
	b2=	3.06383				
	b3=					
E	=	450	keV	in	Ch	160
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1428117	397.315		
E>450	keV	:	217184	60.42255		
E>1350	keV	:	40002	11.12892		
Energy	integral	:	3.79E+08	keV		
Energy	deposition	rate	:	105411.7	keV/s	
Mean	energy	per	photon	detected	:	265.3102
Dose	Rate	(mGy/a)	-	>450	1.17824	0.060475
Dose	Rate	(mGy/a)	-	>1350	1.18523	0.055959
Dose	rate	(mGy/a)	-	energy	1.617016	0.081167

File	:	e:\rainbow\fo2.asc				
Live	time	(s)	3600			
Energy	calibration	coefficients				
	b1=	-44.22454				
	b2=	3.080214				
	b3=					
E	=	450	keV	in	Ch	160
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	1012200	281.1667		
E>450	keV	:	161944	44.98444		
E>1350	keV	:	30047	8.346389		
Energy	integral	:	2.81E+08	keV		
Energy	deposition	rate	:	78009.51	keV/s	
Mean	energy	per	photon	detected	:	277.4494
Dose	Rate	(mGy/a)	-	>450	0.877197	0.045037
Dose	Rate	(mGy/a)	-	>1350	0.88889	0.042046
Dose	rate	(mGy/a)	-	energy	1.196666	0.060067

File	:	e:\rainbow\zo1.chn				
Live	time	(s)	3596.64			
Energy	calibration	coefficients				
	b1=	-31.33336				
	b2=	3.047619				
	b3=					
E	=	450	keV	in	Ch	157
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	856833	238.2315		
E>450	keV	:	150353	41.80374		
E>1350	keV	:	27286	7.586525		
Energy	integral	:	2.49E+08	keV		
Energy	deposition	rate	:	69314.3	keV/s	
Mean	energy	per	photon	detected	:	290.9535
Dose	Rate	(mGy/a)	-	>450	0.815173	0.041857
Dose	Rate	(mGy/a)	-	>1350	0.807965	0.038247
Dose	rate	(mGy/a)	-	energy	1.063281	0.053372

File	:	e:\rainbow\zo2.chn				
Live	time	(s)	3596.58			
Energy	calibration	coefficients				
	b1=	-26.12733				
	b2=	3.055703				
	b3=					
E	=	450	keV	in	Ch	155
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	872935	242.7125		
E>450	keV	:	156467	43.50438		
E>1350	keV	:	28084	7.808529		
Energy	integral	:	2.59E+08	keV		
Energy	deposition	rate	:	72021.06	keV/s	
Mean	energy	per	photon	detected	:	296.734
Dose	Rate	(mGy/a)	-	>450	0.848336	0.043557
Dose	Rate	(mGy/a)	-	>1350	0.831608	0.039357
Dose	rate	(mGy/a)	-	energy	1.104803	0.055456

File	:	e:\rainbow\zo3.chn				
Live	time	(s)	3596.58			
Energy	calibration	coefficients				
	b1=	-12.68061				
	b2=	3.015707				
	b3=					
E	=	450	keV	in	Ch	153
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	870777	242.1125		
E>450	keV	:	158721	44.13109		
E>1350	keV	:	27890	7.754589		
Energy	integral	:	2.68E+08	keV		
Energy	deposition	rate	:	74400.79	keV/s	
Mean	energy	per	photon	detected	:	307.2984
Dose	Rate	(mGy/a)	-	>450	0.860556	0.044184
Dose	Rate	(mGy/a)	-	>1350	0.825864	0.039087
Dose	rate	(mGy/a)	-	energy	1.141308	0.057289

File	:	e:\rainbow\zo4.chn				
Live	time	(s)	3596.78			
Energy	calibration	coefficients				
	b1=	-53.46518				
	b2=	3.080214				
	b3=					
E	=	450	keV	in	Ch	163
Integrated	counts,	count	rates	(cps)		
Total	spectrum	:	816922	227.1259		
E>450	keV	:	141879	39.44612		
E>1350	keV	:	25981	7.223405		
Energy	integral	:	2.26E+08	keV		
Energy	deposition	rate	:	62782.75	keV/s	
Mean	energy	per	photon	detected	:	276.4226
Dose	Rate	(mGy/a)	-	>450	0.769199	0.039499
Dose	Rate	(mGy/a)	-	>1350	0.769293	0.036431
Dose	rate	(mGy/a)	-	energy	0.963087	0.048343

C.4. Cosmic dose rate

Sample Number			Approx. Latitude	Prescott & Stephan (1982) Parameters for Eqn. 1[a.] Read from Fig. 2			Approx. Altitude	Surface Cosmic Dose Rate	Depth below surface	Present Cosmic Dose Rate	Approx. Age	Representative Values (Est. from context and a		
SUERC	Field											Depth below surface		Cosmic Dose Rate
			N	*F*	*J*	*H*	(km)	(Gy/ka)	(cm)[b.]	(Gy/ka)[c,d]	(ka)	Estimation	Estimated (cm)	(Gy/ka)[c,d,e]
SUTL 2090	C009	B1	8	0.38	0.55	0.72	0.1	0.286	*48*	0.21		.=present	48	0.21 ± 0.01
SUTL 2091	C009	B2	8	0.38	0.55	0.72	0.1	0.286	*110*	0.19	1.7	.=present	110	0.19 ± 0.01
SUTL 2092	C009	T1	8	0.38	0.55	0.72	0.1	0.286	*17*	0.25		.=present/2	9	0.27 ± 0.03
SUTL 2093	C009	T2	8	0.38	0.55	0.72	0.1	0.286	*36*	0.22		.=present/2	18	0.25 ± 0.04
SUTL 2094	C018	1	8	0.38	0.55	0.72	0.1	0.286	*32*	0.23	0.4	.=present/2	16	0.25 ± 0.04
SUTL 2095	C018	2	8	0.38	0.55	0.72	0.1	0.286	*69*	0.20	0.9	.=present/2	34.5	0.23 ± 0.04
SUTL 2096	E400	1	8	0.38	0.55	0.72	0.1	0.286	*84*	0.19		.=present	84	0.19 ± 0.01
SUTL 2097	E400	2	8	0.38	0.55	0.72	0.1	0.286	*164*	0.17	2.4	.=present/2	82	0.19 ± 0.03
SUTL 2098	E400	3	8	0.38	0.55	0.72	0.1	0.286	*173*	0.17	3.6	.=present/2	87	0.19 ± 0.03
SUTL 2099	F101	0	8	0.38	0.55	0.72	0.1	0.286	*80*	0.20		.=present/2	40	0.22 ± 0.04
SUTL 2100	F102	1	8	0.38	0.55	0.72	0.1	0.286	*56*	0.21		.=present/2	28	0.23 ± 0.04
SUTL 2101	F102	2	8	0.38	0.55	0.72	0.1	0.286	*80*	0.20		.=present/2	40	0.22 ± 0.04
SUTL 2102	Z021	1	8	0.38	0.55	0.72	0.1	0.286	*256*	0.16	6.6	.=present	256	0.16 ± 0.01
SUTL 2103	Z021	2	8	0.38	0.55	0.72	0.1	0.286	*298*	0.15	6.3	.=present	298	0.15 ± 0.01
SUTL 2104	Z021	3	8	0.38	0.55	0.72	0.1	0.286	*345*	0.14	5.6	.=present	345	0.14 ± 0.01
SUTL 2105	Z021	4	8	0.38	0.55	0.72	0.1	0.286	*384*	0.14	5.8	.=present	384	0.14 ± 0.01
SUTL 2106	Z021	T	8	0.38	0.55	0.72	0.1	0.286	*39*	0.22	0.9	.=present/2	19.5	0.25 ± 0.04
SUTL 2214	F517	1	8	0.38	0.55	0.72	0.1	0.286	*75*	0.20	1.0	.=present/2	37.5	0.22 ± 0.04
SUTL 2215	F517	2	8	0.38	0.55	0.72	0.1	0.286	*151*	0.18	1.3	.=present/2	75.5	0.20 ± 0.03
SUTL 2216	D339	1	8	0.38	0.55	0.72	0.1	0.286	*31*	0.23	0.9	.=present/2	15.5	0.25 ± 0.03
SUTL 2217	D339	2	8	0.38	0.55	0.72	0.1	0.286	*54*	0.21	4.2	.=present/2	27	0.23 ± 0.04
SUTL 2218	D339	3	8	0.38	0.55	0.72	0.1	0.286	*73*	0.20	20.3	.=present/2	36.5	0.22 ± 0.04
SUTL 2219	C115	1	8	0.38	0.55	0.72	0.1	0.286	*25*	0.24	0.1	.=present/2	12.5	0.26 ± 0.03
SUTL 2220	C115	2	8	0.38	0.55	0.72	0.1	0.286	*115*	0.18	1.7	.=present/2	57.5	0.21 ± 0.03
SUTL 2221	C115	3	8	0.38	0.55	0.72	0.1	0.286	*138*	0.18	0.9	.=present/2	69	0.20 ± 0.03
SUTL 2222	Z021a	1	8	0.38	0.55	0.72	0.1	0.286	*65*	0.20	2.2	.=present	65	0.20 ± 0.01
SUTL 2223	Z021a	2	8	0.38	0.55	0.72	0.1	0.286	*79*	0.20	1.7	.=present	79	0.20 ± 0.01
SUTL 2224	Z021a	2a	8	0.38	0.55	0.72	0.1	0.286	*82*	0.19	1.4	.=present	82	0.19 ± 0.01
SUTL 2225	Z021a	2b	8	0.38	0.55	0.72	0.1	0.286	*84*	0.19	0.0	.=present	84	0.19 ± 0.01
SUTL 2226	Z021a	3	8	0.38	0.55	0.72	0.1	0.286	*95*	0.19	1.5	.=present	95	0.19 ± 0.01
SUTL 2227	Z021a	4	8	0.38	0.55	0.72	0.1	0.286	*119*	0.18	2.0	.=present	119	0.18 ± 0.01

a. Cosmic dose rate as a fn. of altitude = K*(F+J*exp(h/H)): h = altitude (km) (Prescott & Stephan, 1982)

b. Depth values in normal text were quoted in fieldwork notes, those in italics were inferred from photos and notes

c. Sediment bulk density assumed = 1.6 g/cm^3

d. Cosmic dose rate as a fn. of depth =0.08*EXP(-0.02*(d*1.6))+0.21*EXP(-0.0007*(d*1.6)+0.00000008*(d*1.6)^2): d = mass depth (g/cm2), parameters from fit to data in Prescott and Hutton (1988)

e. Estimated error = 5%Dcrep. + |Dcpresent-Dcrep.|

C.5. Water content

Sample Number SUERC	Field	Subsample for Water Content Determinations: Sample From	"InSitu" date	Mass inc.T&G (g)	Sat. Soak date	Mass inc.T&G (g)	DUL Drip Dry date	Mass inc.T&G (g)	Dry date	Mass inc.T&G (g)	Tube + Gauze (g)	Water Content as Mass Fraction: ISWC/ Dry Sed	SatWC/ Dry Sed	DULWC/ Dry Sed	Expected Burial
SUTL 2090	C009 B1	all, in tube	211206	161.2	211206	175.3	221206	174.6	50107	153.9	51.4	0.07	0.21	0.20	0.14 ± 0.05
SUTL 2091	C009 B2	all, in tube	211206	145.5	211206	161.3	221206	160.8	50107	139.8	51.4	0.06	0.24	0.24	0.15 ± 0.06
SUTL 2092	C009 T1	all, in tube	211206	272.9	211206	298.4	221206	296.3	50107	269.1	153.4	0.03	0.25	0.24	0.13 ± 0.07
SUTL 2093	C009 T2	all, in tube	211206	267.4	211206	279.6	221206	279.4	50107	261.9	152.5	0.05	0.16	0.16	0.11 ± 0.04
SUTL 2094	C018 1	all, in tube	211206	195.8	211206	209.6	221206	209.1	50107	187.9	50.4	0.06	0.16	0.15	0.11 ± 0.03
SUTL 2095	C018 2	all, in tube	211206	191.2	211206	201.1	221206	200.8	50107	186.1	119.9	0.08	0.23	0.22	0.15 ± 0.05
SUTL 2096	E400 1	all, in tube	211206	196.5	211206	205.1	221206	204.2	50107	193.5	154.7	0.08	0.30	0.28	0.18 ± 0.07
SUTL 2097	E400 2	all, in tube	211206	218.8	211206	226.6	221206	225.8	50107	210.5	155.1	0.15	0.29	0.28	0.21 ± 0.04
SUTL 2098	E400 3	all, in tube	211206	210.0	211206	219.1	221206	217.9	50107	203.8	153.1	0.12	0.30	0.28	0.20 ± 0.06
SUTL 2099	F101	all, in tube	211206	223.8	211206	239.6	221206	239.1	50107	218.1	153.2	0.09	0.33	0.32	0.21 ± 0.08
SUTL 2100	F102 1	all, in tube	211206	240.0	211206	253.6	221206	253.1	50107	235.8	153.4	0.05	0.22	0.21	0.13 ± 0.06
SUTL 2101	F102 2	all, in tube	211206	206.5	211206	223.9	221206	223.5	50107	203.1	157.4	0.07	0.46	0.45	0.26 ± 0.13
SUTL 2102	Z021 1	all, in tube	211206	245.0	211206	252.4	221206	252.0	50107	239.7	152.8	0.06	0.15	0.14	0.10 ± 0.03
SUTL 2103	Z021 2	all, in tube	211206	215.5	211206	223.8	221206	223.3	50107	185.7	109.6	0.10	0.50	0.49	0.30 ± 0.14
SUTL 2104	Z021 3	all, in tube	211206	253.9	211206	261.3	221206	260.7	50107	247.2	154.1	0.07	0.15	0.15	0.11 ± 0.03
SUTL 2105	Z021 4	all, in tube	211206	183.7	211206	190.2	221206	189.5	50107	176.1	101.3	0.10	0.19	0.18	0.14 ± 0.03
SUTL 2106	Z021 T	all, in tube	211206	171.5	211206	180.1	221206	179.5	50107	169.7	152.5	0.10	0.60	0.57	0.34 ± 0.16
SUTL 2214	F517 1	all, in tube	131107	211.4	141107	230.0	161107	224.5	221107	207.4	126.4	0.05	0.28	0.21	0.13 ± 0.06
SUTL 2215	F517 2	all, in tube	131107	205.3	141107	222.3	161107	216.5	221107	198.6	127.5	0.09	0.33	0.25	0.17 ± 0.06
SUTL 2216	D339 1	all, in tube	131107	212.6	141107	238.1	161107	228.6	221107	208.9	127.7	0.05	0.36	0.24	0.14 ± 0.07
SUTL 2217	D339 2	all, in tube	131107	230.6	141107	251.7	161107	246.2	221107	228.8	126.4	0.02	0.22	0.17	0.09 ± 0.05
SUTL 2218	D339 3	all, in tube	131107	197.1	141107	217.7	161107	210.0	221107	194.8	113.3	0.03	0.28	0.19	0.11 ± 0.06
SUTL 2219	C115 1	all, in tube	131107	202.3	141107	217.3	161107	214.2	221107	194.2	128.6	0.12	0.35	0.31	0.21 ± 0.06
SUTL 2220	C115 2	all, in tube	131107	220.1	141107	234.0	161107	226.1	221107	216.3	128.0	0.04	0.20	0.11	*0.12 ± 0.06*
SUTL 2221	C115 3	all, in tube	131107	220.5	141107	232.0	161107	226.1	221107	215.4	126.9	0.06	0.19	0.12	*0.12 ± 0.05*
SUTL 2222	Z021a 1	all, in tube	131107	199.3	141107	209.0	161107	207.5	221107	197.5	126.8	0.03	0.16	0.14	0.08 ± 0.04
SUTL 2223	Z021a 2	all, in tube	131107	179.9	141107	191.6	161107	188.6	221107	177.6	127.4	0.05	0.28	0.22	0.13 ± 0.06
SUTL 2224	Z021a 2a	all, in tube	131107	188.3	141107	197.3	161107	194.5	221107	185.6	126.6	0.05	0.20	0.15	0.10 ± 0.04
SUTL 2225	Z021a 2b	all, in tube	131107	174.2	141107	184.8	161107	181.3	221107	170.9	100.3	0.05	0.20	0.15	0.10 ± 0.04
SUTL 2226	Z021a 3	all, in tube	131107	205.7	141107	216.9	161107	214.6	221107	203.5	126.7	0.03	0.17	0.14	0.09 ± 0.04
SUTL 2227	Z021a 4	all, in tube	131107	216.3	141107	234.1	161107	228.1	221107	214.8	128.5	0.02	0.22	0.15	0.09 ± 0.05

Appendix D. Equivalent dose determinations

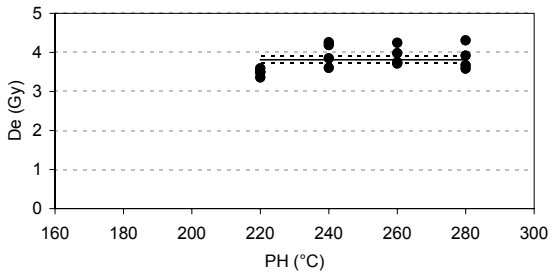
Sample SUTL 2091
Date 150307 to 180307
Reader Riso 1
Source Calibration 0.1023 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

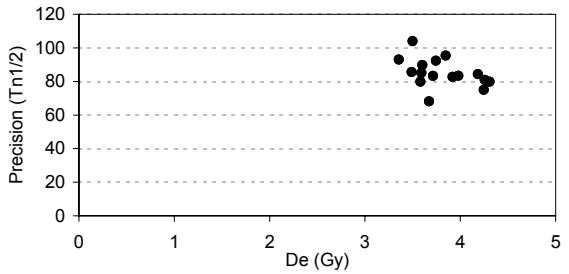
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.34	-0.01	6.13	6.13

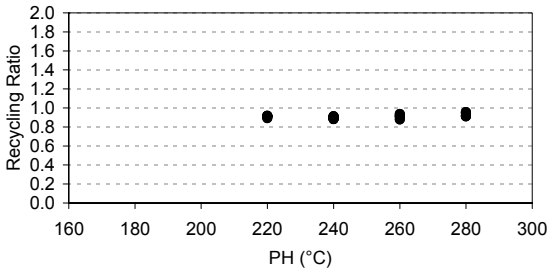
Test Dose (Gy) 1.01

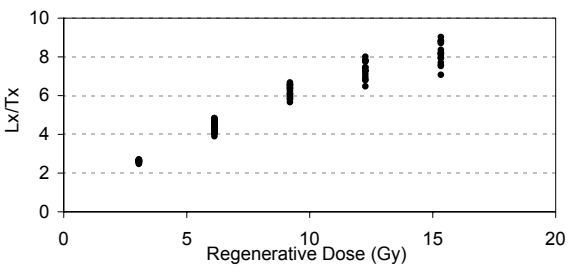
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

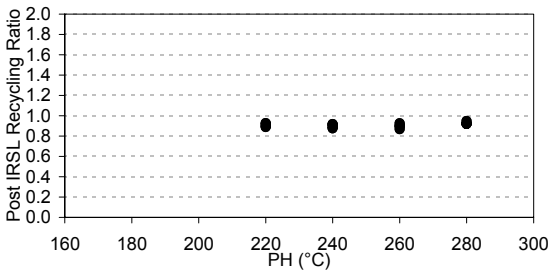
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.13 Gy		Post IRSL 6.13 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
2	220	3.5	2445	1.8	12	0	0.91	0.02	0.90	0.02	0.069	0.003	3.356	0.031	*Estimate*	*Estimate*	*Parame*
3	220	4.1	2608	1.7	12	0	0.91	0.02	0.92	0.02	0.065	0.002	3.499	0.031	*Median*	3.72935	
4	220	3.0	2386	1.6	12	0	0.89	0.02	0.89	0.02	0.053	0.003	3.591	0.031	*A15 mea*	3.79794	c=1.5: C
5	220	3.4	2131	1.7	13	0	0.92	0.02	0.93	0.02	0.064	0.003	3.489	0.031	*H15 mea*	3.81184	c=1.5: C
6	240	4.2	1540	1.9	14	0	0.91	0.02	0.92	0.02	0.068	0.003	4.256	0.041	*MAD*	0.20974	
7	240	4.7	1697	2.0	14	0	0.88	0.02	0.88	0.02	0.065	0.002	3.601	0.031	*MADe*	0.31097	
8	240	3.3	2132	2.0	12	0	0.88	0.02	0.89	0.02	0.074	0.002	4.185	0.041	*sMAD*	0.31097	
9	240	4.1	2195	1.8	16	0	0.91	0.02	0.91	0.02	0.050	0.002	3.847	0.031	*H15 Std*	0.34639	c=1.5: C
10	260	3.9	1764	2.0	14	0	0.94	0.02	0.93	0.02	0.065	0.002	3.980	0.031			
11	260	4.0	1715	2.1	14	0	0.92	0.02	0.89	0.02	0.067	0.002	3.714	0.031			
12	260	4.2	2007	1.9	14	0	0.91	0.01	0.90	0.01	0.064	0.002	3.745	0.031			
13	260	3.7	1502	2.3	11	0	0.88	0.02	0.87	0.02	0.091	0.003	4.246	0.041			
14	280	3.8	1658	1.8	16	0	0.92	0.02	0.92	0.02	0.063	0.002	3.581	0.031			
15	280	3.5	1932	1.8	17	0	0.96	0.02	0.95	0.02	0.056	0.002	3.919	0.031			
16	280	3.2	1435	1.8	16	0	0.95	0.02	0.92	0.02	0.060	0.002	3.673	0.031			
17	280	3.7	1703	1.7	16	0	0.91	0.02	0.92	0.02	0.061	0.002	4.307	0.031			
													n =	16		n =	16
Mean		3.8	1928	1.9	13.8		0.91		0.91		0.065	Mean	3.812	Internal		H15 mean	3.812
SD		0.4	358	0.2	1.8		0.02		0.02		0.009	SD	0.306	Error		H15 Std Dev	0.346
SD/rtN		0.1	90	0.0	0.5		0.01		0.01		0.002	SD/rtN	0.076	0.008		SD/rtN	0.087
%err		3	5	2	3		1		1		4	%err	2			%err	2

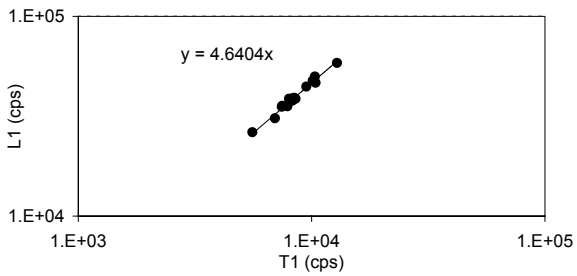


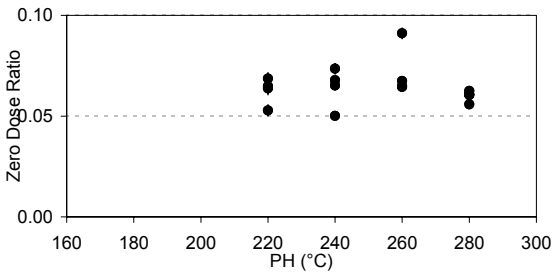


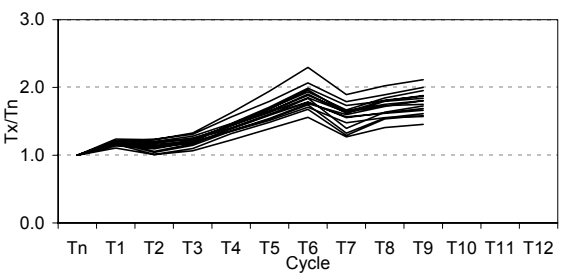












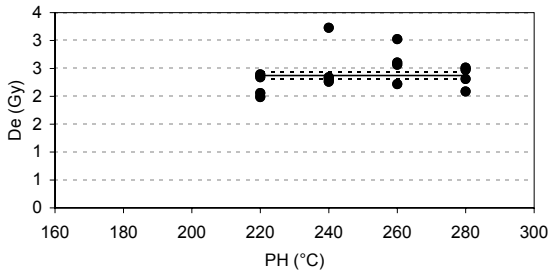
Sample SUTL 2093
Date 040607 to 080607
Reader Riso 1
Source Calibration 0.1018 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

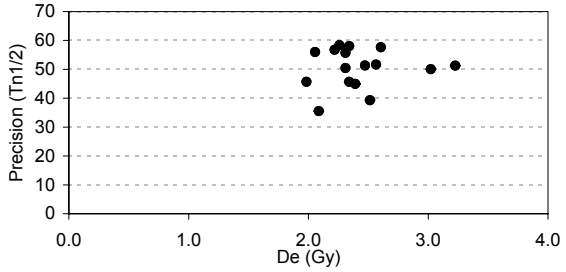
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.10	-0.01	3.04	9.15	12.20	15.25	-0.01	6.10	6.10

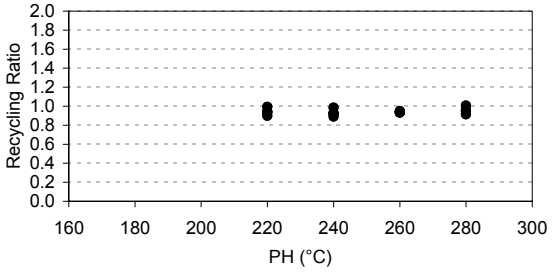
Test Dose (Gy) 1.01

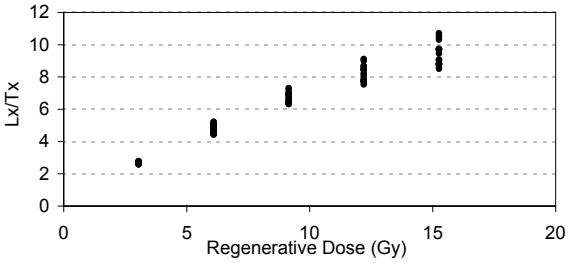
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

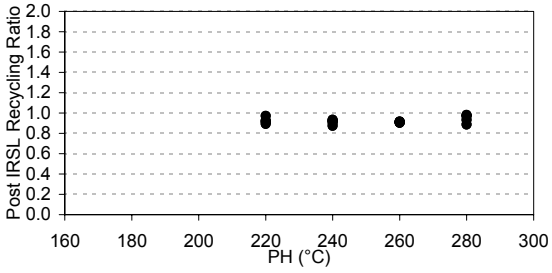
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.10 Gy		Post IRSL 6.10 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	1.7	1218	1.6	16	0.9	0.90	0.04	0.91	0.04	0.039	0.004	1.985	0.031	*Estimate*	*Estimate value*
2	220	1.3	2394	1.6	14	0.5	0.94	0.03	0.93	0.03	0.048	0.003	2.056	0.031	*Median*	2.3408
3	220	0.9	2304	1.6	15	0.8	0.99	0.04	0.97	0.04	0.042	0.004	2.341	0.041	*A15 mea*	2.36457
4	220	1.5	1337	1.5	15	0.9	0.93	0.04	0.89	0.04	0.048	0.005	2.392	0.041	*H15 mea*	2.37243
5	240	2.0	1263	1.7	19	0.9	0.98	0.03	0.93	0.03	0.039	0.003	2.310	0.031	*MAD*	0.15266
6	240	2.4	1409	1.8	16	0.6	0.93	0.02	0.92	0.02	0.054	0.003	2.259	0.031	*MADe*	0.22634
7	240	2.8	1195	1.7	15	0.5	0.89	0.02	0.87	0.02	0.051	0.003	2.341	0.031	*sMAD*	0.22634
8	240	1.8	1451	1.6	18	0.9	0.92	0.03	0.91	0.03	0.036	0.003	3.226	0.041	*H15 Std*	0.25545
9	260	2.4	1333	1.7	16	0.6	0.93	0.02	0.90	0.02	0.053	0.003	2.219	0.031		
10	260	2.4	1038	1.6	19	0.9	0.95	0.03	0.91	0.03	0.042	0.003	3.023	0.041		
11	260	2.8	948	1.7	19	0.9	0.93	0.03	0.92	0.03	0.038	0.002	2.565	0.031		
12	260	2.4	1375	1.7	20	0.8	0.94	0.02	0.91	0.02	0.049	0.002	2.605	0.031		
13	280	1.4	1096	1.5	22	1.5	0.95	0.04	0.97	0.04	0.030	0.003	2.514	0.041		
14	280	2.5	1046	1.5	22	1.1	0.96	0.03	0.93	0.03	0.037	0.002	2.473	0.031		
15	280	1.6	1928	1.4	26	1.3	1.01	0.03	0.98	0.03	0.029	0.002	2.310	0.031		
16	280	1.3	965	1.6	16	0.9	0.91	0.04	0.89	0.04	0.054	0.004	2.086	0.041		
													n =	16		n = 16
Mean		2.0	1394	1.6	18.1		0.94		0.92		0.043	Mean	2.419	Internal		H15 mean 2.372
SD		0.6	442	0.1	3.3		0.03		0.03		0.008	SD	0.328	Error		H15 Std Dev 0.255
SD/rtN		0.1	111	0.0	0.8		0.01		0.01		0.002	SD/rtN	0.082	0.009		SD/rtN 0.064
%err		8	8	2	5		1		1		5	%err	3			%err 3

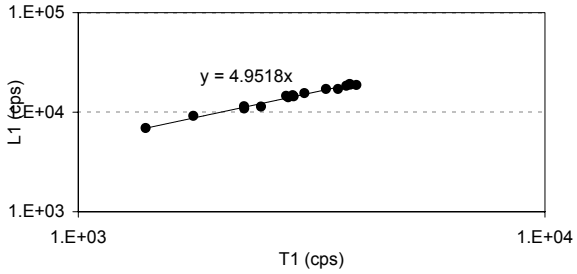


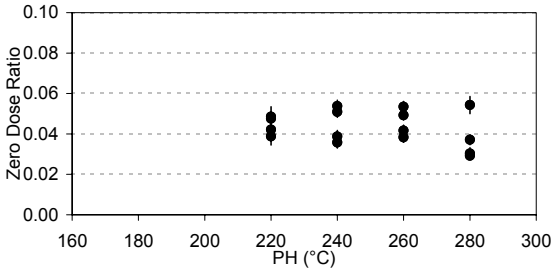


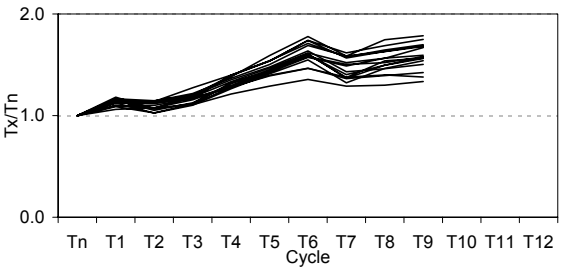












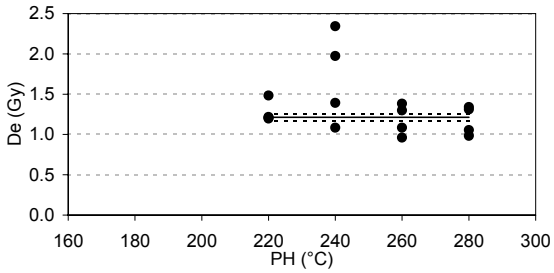
Sample SUTL 2094
Date 150307 to 180307
Reader Riso 1
Source Calibration 0.1023 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

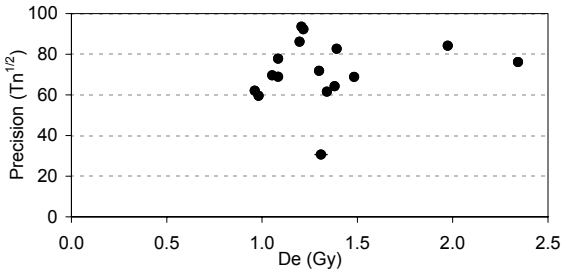
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.34	-0.01	6.13	6.13

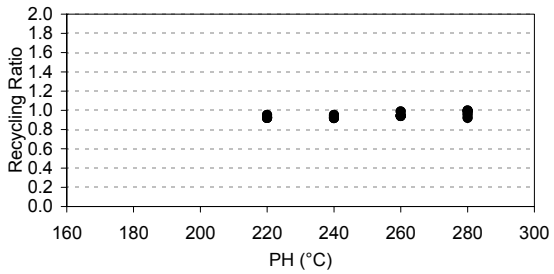
Test Dose (Gy) 1.01

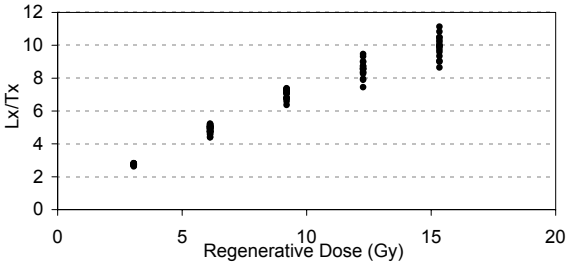
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

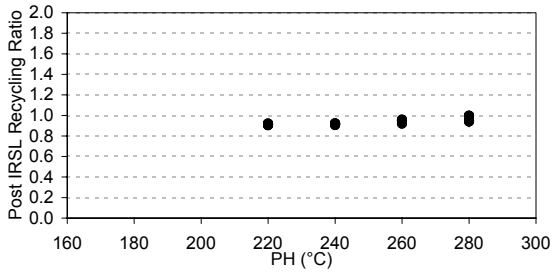
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.13 Gy		Post IRSL 6.13 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SU		
19	220	2.1	2226	1.4	16	1	0.93	0.03	0.90	0.02	0.032	0.003	1.484	0.020	*Estimate*	*Estimate*	*Parame*
20	220	4.1	2109	1.5	15	0	0.92	0.02	0.91	0.02	0.040	0.002	1.207	0.010	*Median*	1.25846	
21	220	4.1	2052	1.4	15	0	0.95	0.02	0.91	0.02	0.041	0.002	1.218	0.010	*A15 mea*	1.26212	c=1.5: C
22	220	3.6	2036	1.5	14	0	0.92	0.02	0.92	0.02	0.047	0.003	1.197	0.010	*H15 mea*	1.26022	c=1.5: C
23	240	2.6	2600	1.5	19	1	0.92	0.02	0.91	0.02	0.033	0.002	1.391	0.010	*MAD*	0.15347	
24	240	2.3	2598	1.5	20	1	0.94	0.02	0.92	0.02	0.037	0.002	1.085	0.010	*MADe*	0.22754	
25	240	2.4	2385	1.6	18	1	0.92	0.02	0.92	0.02	0.039	0.002	2.343	0.020	*sMAD*	0.22754	
26	240	4.0	1750	1.5	21	1	0.95	0.02	0.92	0.02	0.030	0.002	1.975	0.020	*H15 Std*	0.22322	c=1.5: C
27	260	1.4	2914	1.6	25	1	0.94	0.02	0.92	0.02	0.032	0.002	1.381	0.010			
28	260	2.5	1876	1.4	21	1	0.99	0.02	0.96	0.02	0.034	0.002	1.085	0.010			
29	260	1.7	2236	1.6	20	1	0.95	0.02	0.95	0.02	0.039	0.002	0.962	0.010			
30	260	2.2	2319	1.6	22	1	0.94	0.02	0.94	0.02	0.036	0.002	1.299	0.010			
31	280	2.1	2278	1.4	26	1	0.96	0.02	0.95	0.02	0.029	0.002	1.054	0.010			
32	280	1.8	2083	1.4	31	2	1.00	0.02	1.00	0.02	0.027	0.002	1.340	0.010			
33	280	0.8	1157	1.5	22	2	0.92	0.05	0.94	0.05	0.050	0.005	1.310	0.031			
34	280	1.9	1844	1.4	22	1	0.99	0.03	1.00	0.03	0.025	0.002	0.982	0.010			
													n =	16		n =	16
Mean		2.5	2154	1.5	20.5		0.95		0.94		0.036	Mean	1.332	Internal		H15 mean	1.260
SD		1.0	404	0.1	4.3		0.03		0.03		0.007	SD	0.363	Error		H15 Std Dev	0.223
SD/rtN		0.2	101	0.0	1.1		0.01		0.01		0.002	SD/rtN	0.091	0.004		SD/rtN	0.056
%err		10	5	1	5		1		1		5	%err	7			%err	4

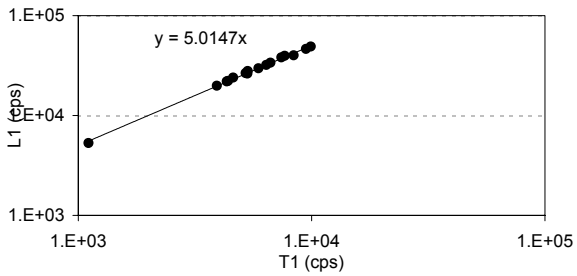


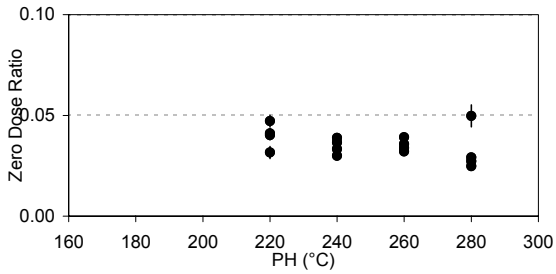


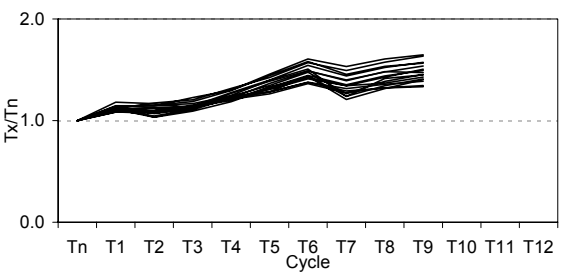












Sample SUTL 2095
Date 50307 to 70307
Reader Riso 1
Source Calibration 0.1024 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.35	-0.01	6.13	6.13

Test Dose (Gy) 1.01

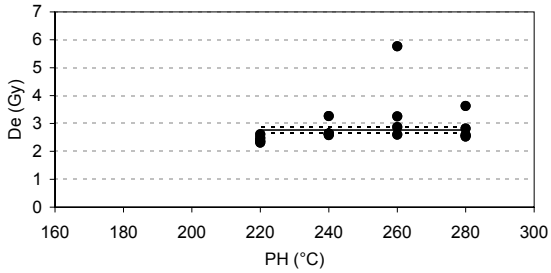
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

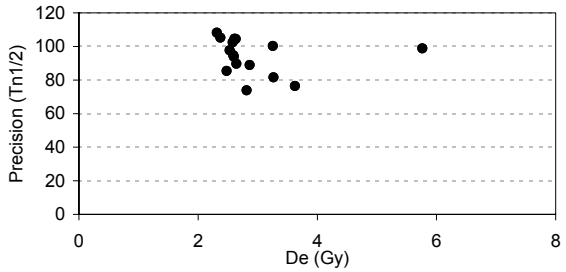
Aliquot	Preheat (°C/30s)	Aliquot Mass (g)	Sensitivity (cps/ mg/Gy)	Change (frn.)	Dose Response D0 (Gy)	Err	Recycling Point 6.13 ratio	Gy error	Post IRSL 6.13 ratio	Gy error	Zero Dose 0.00 ratio	Gy error	Equivalent Dose (Gy)	error
2	220	3.2	3612	1.4	16	0	0.92	0.02	0.94	0.02	0.039	0.002	2.314	0.020
3	220	4.4	2486	1.4	15	0	0.91	0.02	0.92	0.02	0.037	0.002	2.375	0.020
4	220	3.4	2117	1.4	16	1	0.94	0.02	0.94	0.02	0.037	0.003	2.478	0.020
5	220	4.2	2570	1.6	15	0	0.90	0.02	0.91	0.02	0.047	0.002	2.611	0.020
6	240	3.9	2659	1.5	20	1	0.94	0.02	0.94	0.02	0.032	0.002	2.580	0.020
7	240	2.8	2348	1.4	22	1	0.95	0.02	0.95	0.02	0.030	0.002	3.266	0.031
8	240	4.3	2505	1.7	18	0	0.92	0.01	0.91	0.01	0.042	0.002	2.631	0.020
9	240	3.4	2336	1.5	18	1	0.94	0.02	0.92	0.02	0.040	0.002	2.641	0.020
10	260	3.7	2111	1.7	18	0	0.95	0.02	0.95	0.02	0.046	0.002	2.867	0.020
11	260	3.4	2559	1.6	20	1	0.95	0.02	0.94	0.02	0.039	0.001	2.600	0.020
12	260	5.0	1931	1.6	23	1	0.96	0.01	0.96	0.01	0.034	0.001	5.764	0.041
13	260	4.5	2205	1.6	21	1	0.95	0.01	0.94	0.01	0.035	0.001	3.256	0.020
14	280	4.0	2355	1.4	29	1	0.98	0.02	0.98	0.01	0.024	0.001	2.529	0.020
15	280	3.0	1923	1.4	29	1	0.98	0.02	0.99	0.02	0.022	0.001	3.624	0.031
16	280	2.2	2451	1.4	27	1	0.98	0.02	0.98	0.02	0.026	0.002	2.815	0.020
17	280	4.0	2217	1.4	26	1	0.97	0.02	0.97	0.02	0.027	0.001	2.590	0.020
													n =	16
Mean		3.7	2399	1.5	20.8		0.95		0.95		0.035	Mean	2.934	Internal
SD		0.7	392	0.1	4.8		0.03		0.02		0.008	SD	0.834	Error
SD/rtN		0.2	98	0.0	1.2		0.01		0.01		0.002	SD/rtN	0.208	0.006
%err		5	4	2	6		1		1		5	%err	7	

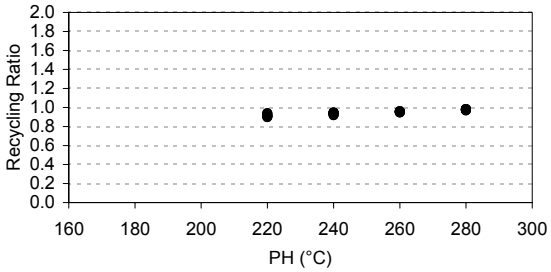
AMC Robust Statistics V1.0

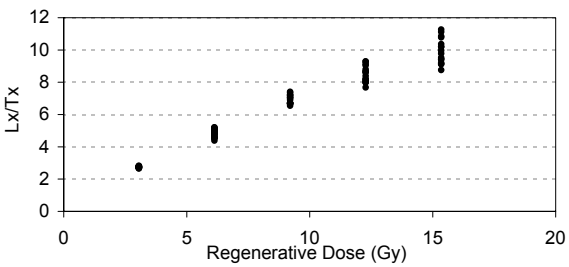
Estimate	*Estimate*	*Paramet*
ROBUST	3.72935	
Estimate	*Estimate*	c=1.5: C
Median	2.62097	c=1.5: C
A15 mea	2.68865	
H15 mea	2.76361	
MAD	0.16893	
MADe	0.25046	c=1.5: C
sMAD	0.250	
H15 Std	0.392	

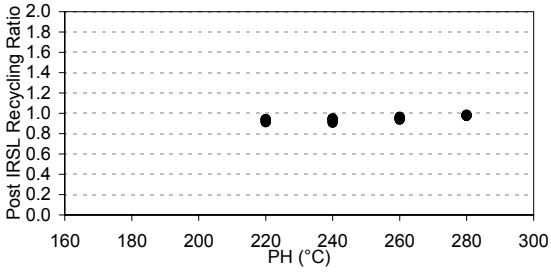
		n =	16
H15 mean	2.764		
H15 Std Dev	0.392		
SD/rtN	0.098		
%err	4		

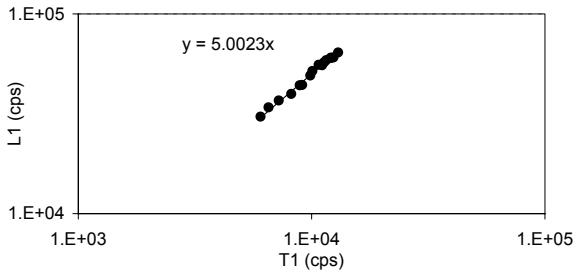


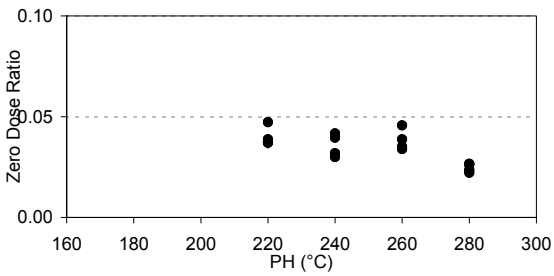


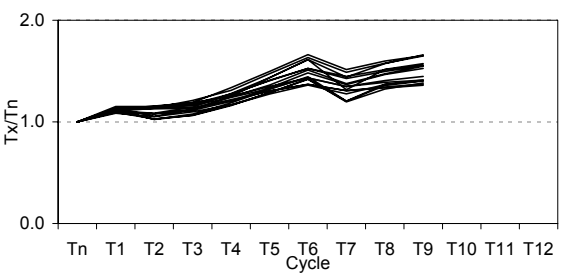












Sample SUTL 2097
Date 50307 to 70307
Reader Riso 1
Source Calibration 0.1024 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.35	-0.01	6.13	6.13

Test Dose (Gy) 1.01

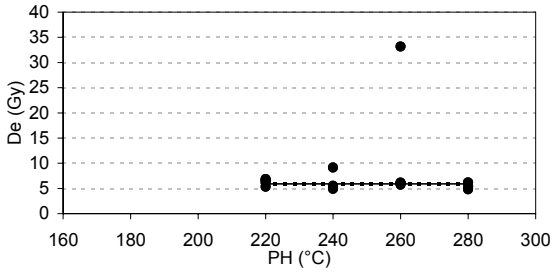
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

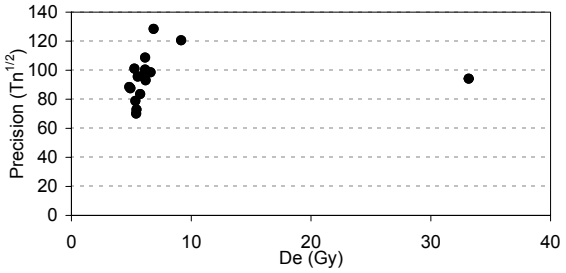
Aliquot	Preheat (°C/30s)	Aliquot Mass (g)	Sensitivity (cps/ mg/Gy)	Change (frn.)	Dose Response D0 (Gy)	Err	Recycling Point 6.13 ratio	Gy error	Post IRSL 6.13 ratio	Gy error	Zero Dose 0.00 ratio	Gy error	Equivalent Dose (Gy)	error
19	220	5.6	2082	1.4	18	1	0.94	0.02	0.94	0.02	0.039	0.002	6.153	0.051
20	220	6.1	2671	1.3	16	0	0.92	0.01	0.93	0.01	0.048	0.002	6.870	0.041
21	220	3.2	1919	1.3	18	1	0.93	0.02	0.91	0.02	0.037	0.003	5.344	0.051
22	220	4.3	2233	1.3	15	0	0.93	0.02	0.92	0.02	0.042	0.002	6.614	0.061
23	240	3.7	2729	1.4	26	1	0.94	0.02	0.97	0.02	0.021	0.001	5.262	0.031
24	240	4.0	1893	1.4	20	1	0.94	0.02	0.93	0.02	0.033	0.002	4.925	0.041
25	240	5.1	1767	1.4	23	1	0.96	0.02	0.94	0.02	0.021	0.002	5.539	0.041
26	240	5.1	2815	1.3	22	1	0.95	0.01	0.95	0.01	0.030	0.001	9.163	0.051
27	260	3.1	2826	1.2	26	1	0.98	0.02	0.98	0.02	0.032	0.001	33.172	0.369
28	260	4.6	1996	1.4	23	1	0.97	0.02	0.97	0.02	0.032	0.001	5.989	0.041
29	260	3.4	2029	1.4	24	1	0.99	0.02	0.98	0.02	0.025	0.002	5.744	0.041
30	260	4.2	2369	1.4	25	1	0.97	0.02	0.97	0.02	0.034	0.001	6.153	0.041
31	280	3.3	2592	1.2	27	1	1.00	0.02	0.97	0.02	0.023	0.001	6.194	0.041
32	280	2.7	1944	1.2	27	1	1.00	0.02	0.97	0.02	0.031	0.002	5.436	0.041
33	280	2.3	2110	1.3	34	2	1.02	0.02	1.00	0.02	0.017	0.001	5.406	0.041
34	280	4.0	1932	1.3	27	1	1.01	0.02	1.00	0.02	0.025	0.001	4.832	0.031
													n =	16
Mean		4.0	2244	1.3	23.3		0.96		0.96		0.031	Mean	7.675	Internal
SD		1.1	367	0.1	5.0		0.03		0.03		0.008	SD	6.875	Error
SD/rtN		0.3	92	0.0	1.3		0.01		0.01		0.002	SD/rtN	1.719	0.025
%err		7	4	1	5		1		1		7	%err	22	

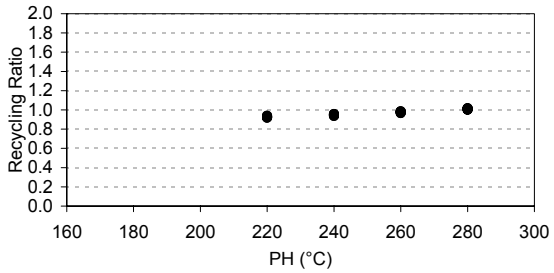
AMC Robust Statistics V1.0

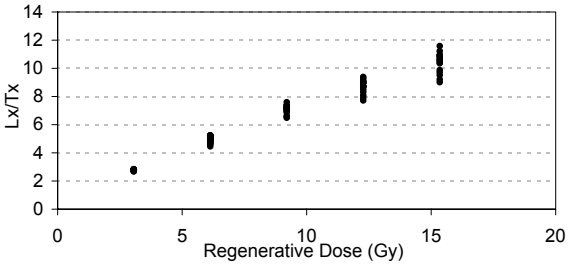
Estimate	*Estimate*	*Paramet*
ROBUST	3.72935	
Estimate	*Estimate*	c=1.5: C
Median	5.86646	c=1.5: C
A15 mea	5.89877	
H15 mea	5.92011	
MAD	0.49143	
MADe	0.7286	c=1.5: C
sMAD	0.729	
H15 Std	0.834	

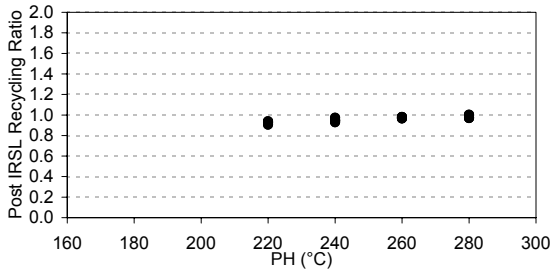
n =	16
H15 mean	5.920
H15 Std Dev	0.834
SD/rtN	0.208
%err	4

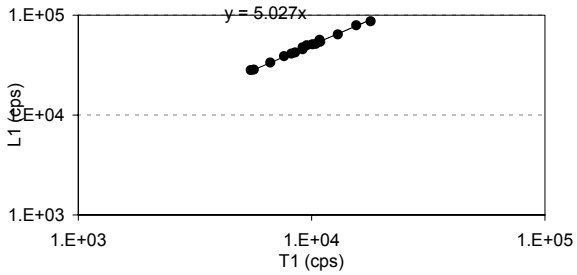


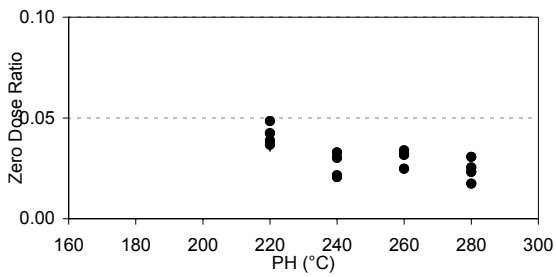


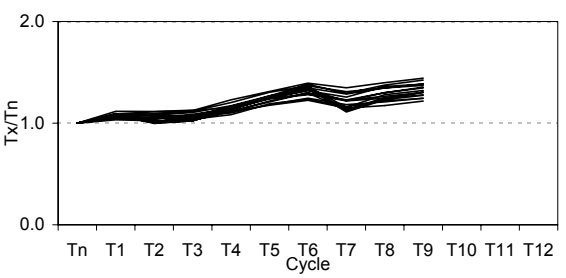












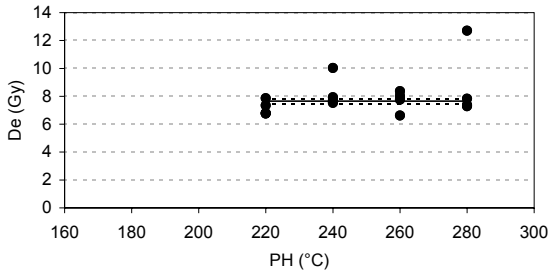
Sample SUTL 2098
Date 80307 to 110307
Reader Riso 1
Source Calibration 0.1024 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

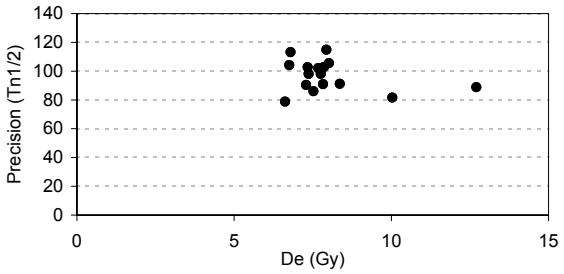
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.34	-0.01	6.13	6.13

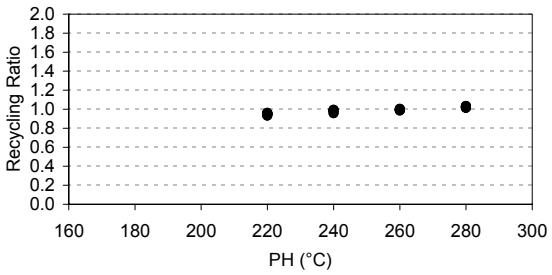
Test Dose (Gy) 1.01

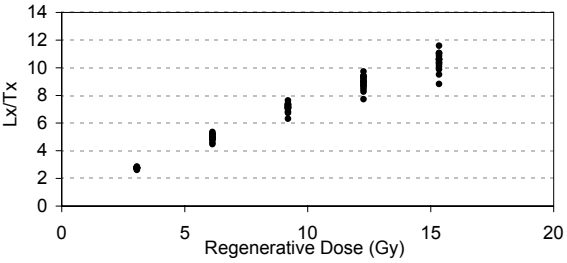
Measurement	Signal	Background
OSL 60s@125°C, 240CI	11-30	191-230
IRSL 120s@50°C, 240CI	11-30	191-230

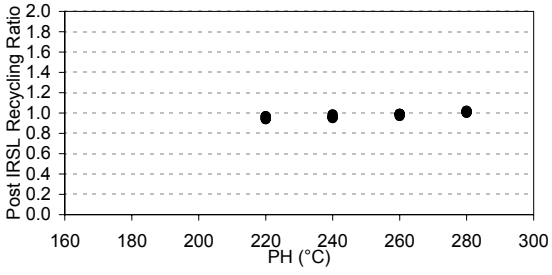
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.13 Gy		Post IRSL 6.13 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
1	220	5.7	2220	1.2	21	0.7	0.96	0.02	0.97	0.02	0.031	0.002	6.797	0.051	*Estimate*	*Estimate*	*Parame*
2	220	4.3	2426	1.2	19	0.7	0.94	0.02	0.97	0.02	0.020	0.002	7.339	0.061	*Median*	7.71804	
3	220	4.4	2439	1.2	19	0.6	0.95	0.02	0.94	0.02	0.016	0.002	6.756	0.051	*A15 mea*	7.65018	c=1.5: C
4	220	4.6	2272	1.3	16	0.5	0.93	0.02	0.94	0.02	0.025	0.002	7.861	0.072	*H15 mea*	7.65673	c=1.5: C
5	240	5.0	2061	1.2	24	0.8	0.99	0.02	0.96	0.02	0.013	0.001	7.677	0.051	*MAD*	0.36338	
6	240	3.5	2091	1.3	22	0.9	0.96	0.02	0.95	0.02	0.014	0.002	7.524	0.072	*MADe*	0.53875	
7	240	5.7	2288	1.3	24	0.7	0.99	0.02	0.99	0.02	0.013	0.001	7.933	0.051	*sMAD*	0.53875	
8	240	3.2	2054	1.3	22	0.9	0.99	0.02	0.96	0.02	0.018	0.002	10.031	0.102	*H15 Std*	0.70643	c=1.5: C
9	260	4.5	2112	1.3	24	0.8	0.99	0.02	0.98	0.02	0.016	0.001	7.759	0.051			
10	260	4.4	2503	1.4	28	0.9	1.00	0.02	0.99	0.02	0.014	0.001	8.015	0.051			
11	260	2.9	2116	1.4	23	0.8	0.99	0.02	0.99	0.02	0.015	0.001	6.623	0.051			
12	260	3.8	2163	1.3	24	0.9	1.00	0.02	0.97	0.02	0.015	0.001	8.363	0.061			
13	280	3.9	2069	1.1	35	1.6	1.03	0.02	1.02	0.02	0.011	0.001	7.288	0.051			
14	280	4.7	2020	1.2	30	1.1	1.02	0.02	1.00	0.02	0.016	0.001	7.370	0.051			
15	280	3.5	2337	1.3	26	0.9	1.02	0.02	1.02	0.02	0.013	0.001	7.831	0.051			
16	280	3.9	2001	1.2	29	1.2	1.02	0.02	1.01	0.02	0.019	0.001	12.703	0.092			
													n =	16		n =	16
Mean		4.3	2198	1.3	24.2		0.99		0.98		0.017	Mean	7.992	Internal		H15 mean	7.657
SD		0.8	161	0.1	4.7		0.03		0.03		0.005	SD	1.484	Error		H15 Std Dev	0.706
SD/rtN		0.2	40	0.0	1.2		0.01		0.01		0.001	SD/rtN	0.371	0.016		SD/rtN	0.177
%err		5	2	1	5		1		1		7	%err	5			%err	2

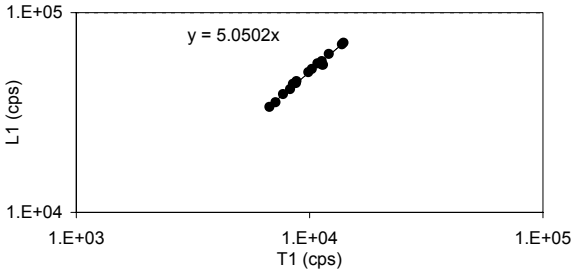


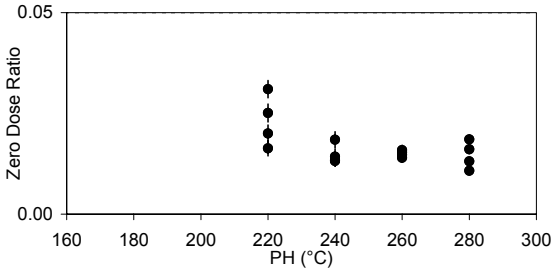


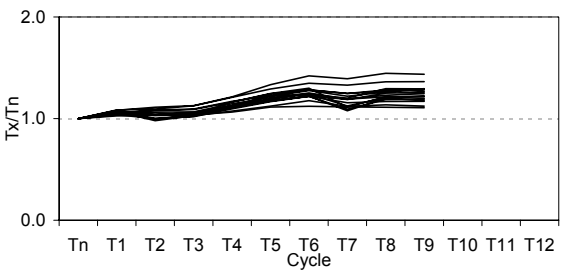












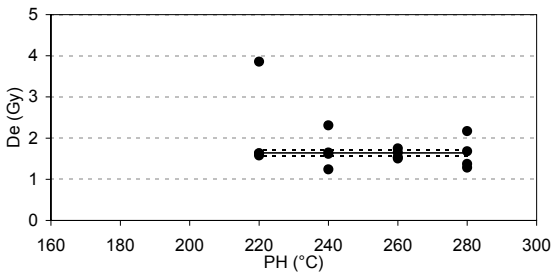
Sample SUTL 2099
Date 040607 to 080607
Reader Riso 1
Source Calibration 0.1018 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

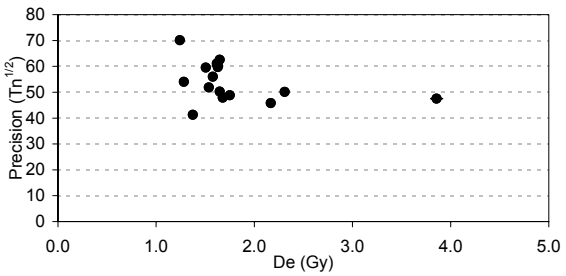
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.10	-0.01	3.04	9.15	12.20	15.25	-0.01	6.10	6.10

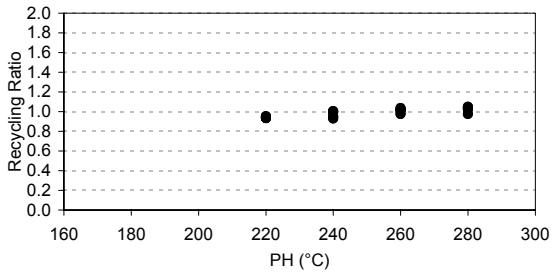
Test Dose (Gy) 1.01

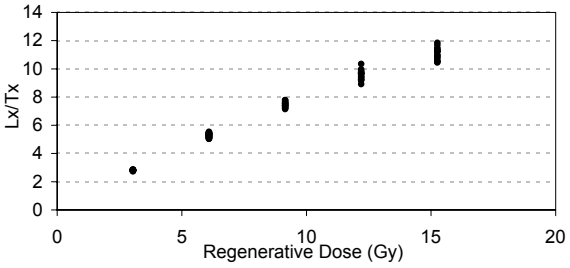
Measurement	Signal	Background
OSL 60s@125°C, 240CI	11-30	191-230
IRSL 120s@50°C, 240CI	11-30	191-230

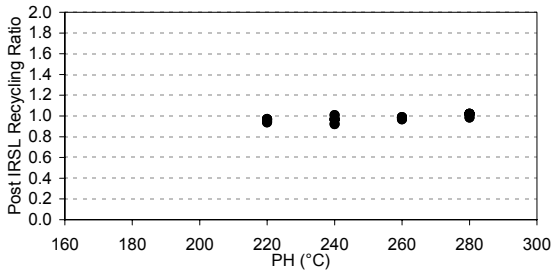
Aliquot	Preheat (°C/30s)	Aliquot Mass (g)	Sensitivity (cps/ mg/Gy)	Change (frn.)	Dose Response D0 (Gy)	Err	Recycling Point 6.10 ratio	Gy error	Post IRSL 6.10 ratio	Gy error	Zero Dose 0.00 ratio	Gy error	Equivalent Dose (Gy)	error	AMC Robust Statistics V1.0
17	220	2.4	1476	1.3	21	1.4	0.95	0.03	0.97	0.03	0.017	0.004	1.628	0.020	*Estimate Estimate Parame*
18	220	1.4	1604	1.2	21	1.7	0.95	0.04	0.97	0.05	0.018	0.005	3.857	0.061	*Median* 1.62838
19	220	2.1	1482	1.3	23	1.7	0.94	0.04	0.94	0.04	0.012	0.004	1.577	0.020	*A15 mea* 1.6223 c=1.5: C
20	220	1.9	1890	1.5	24	1.4	0.93	0.03	0.95	0.03	0.017	0.003	1.628	0.020	*H15 mea* 1.63972 c=1.5: C
21	240	1.7	2285	1.3	21	1.1	0.95	0.03	0.96	0.03	0.017	0.003	1.649	0.020	*MAD* 0.10686
22	240	1.3	1918	1.5	20	1.2	0.93	0.03	0.92	0.03	0.022	0.003	2.310	0.031	*MADe* 0.15843
23	240	1.6	3054	1.5	27	1.4	0.99	0.02	0.97	0.02	0.011	0.002	1.242	0.010	*sMAD* 0.15843
24	240	1.8	2060	1.6	26	1.5	1.01	0.03	1.01	0.03	0.017	0.002	1.618	0.020	*H15 Std* 0.27458 c=1.5: C
25	260	2.5	1409	1.5	27	1.5	0.98	0.03	0.98	0.03	0.011	0.002	1.506	0.020	
26	260	1.6	1481	1.5	26	1.7	1.02	0.03	0.98	0.03	0.008	0.002	1.751	0.020	
27	260	1.7	1475	1.6	26	1.6	1.01	0.03	0.97	0.03	0.016	0.002	1.649	0.020	
28	260	1.6	1669	1.6	28	1.8	1.04	0.03	0.99	0.03	0.012	0.002	1.537	0.020	
29	280	1.2	1410	1.6	31	2.6	1.04	0.04	1.02	0.04	0.006	0.002	1.374	0.020	
30	280	1.7	1704	1.4	33	2.2	0.98	0.03	0.98	0.03	0.012	0.002	1.282	0.020	
31	280	1.2	1737	1.6	40	3.6	1.05	0.03	1.02	0.03	0.008	0.002	2.168	0.031	
32	280	1.3	1753	1.6	33	2.4	1.03	0.03	1.02	0.03	0.014	0.002	1.679	0.020	
													n =	16	n = 16
Mean		1.7	1775	1.5	26.7		0.99		0.98		0.014	Mean	1.779	Internal	H15 mean 1.640
SD		0.4	422	0.1	5.5		0.04		0.03		0.004	SD	0.619	Error	H15 Std Dev 0.275
SD/rtN		0.1	106	0.0	1.4		0.01		0.01		0.001	SD/rtN	0.155	0.006	SD/rtN 0.069
%err		6	6	2	5		1		1		8	%err	9		%err 4

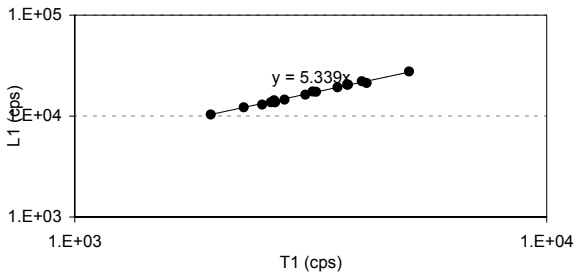


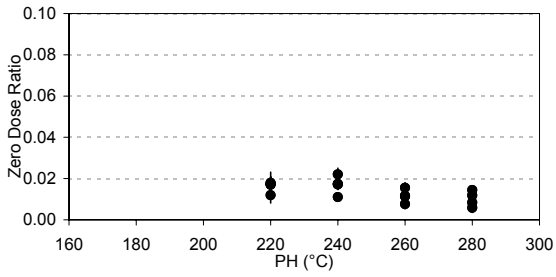


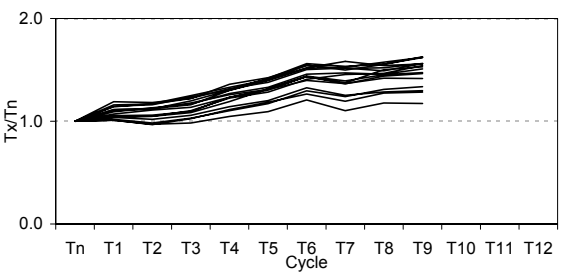












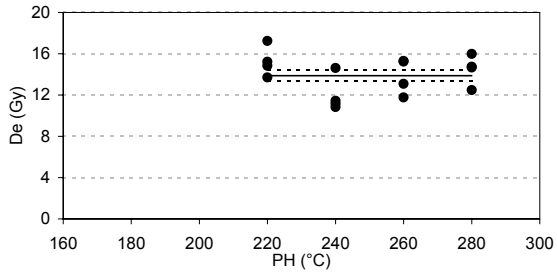
Sample SUTL 2101
Date 040607 to 080607
Reader Riso 1
Source Calibration 0.1018 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

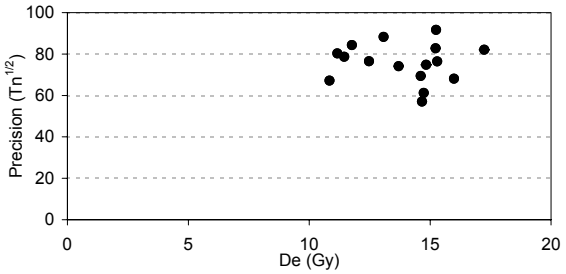
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.10	-0.01	3.04	9.15	12.20	15.25	-0.01	6.10	6.10

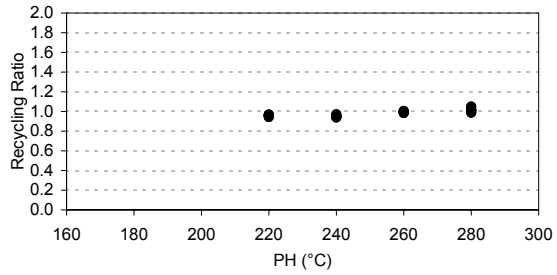
Test Dose (Gy) 1.01

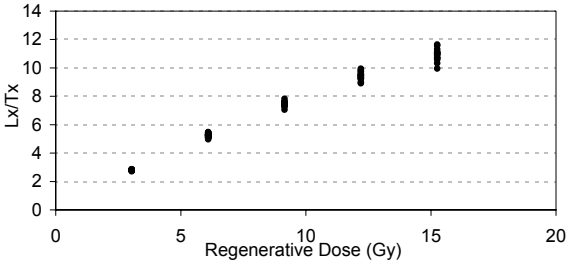
Measurement	Signal	Background
OSL 60s@125°C, 240CI	11-30	191-230
IRSL 120s@50°C, 240CI	11-30	191-230

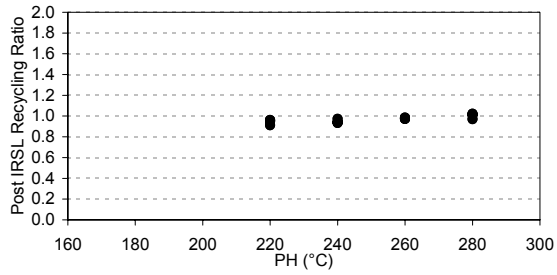
Aliquot	Preheat (°C/30s)	Aliquot Mass (g)	Sensitivity (cps/ mg/Gy)	Change (frn.)	Dose Response D0 (Gy)	Err	Recycling Point 6.10 Gy ratio	error	Post IRSL 6.10 Gy ratio	error	Zero Dose 0.00 Gy ratio	error	Equivalent Dose (Gy)	error	AMC Robust Statistics V1.0
33	220	2.9	2347	1.1	22	1.1	0.96	0.02	0.96	0.02	0.014	0.002	15.225	0.173	*Estimate Estimate Parame*
34	220	2.3	2415	1.1	19	1.0	0.97	0.03	0.95	0.03	0.024	0.003	14.839	0.214	*Median* 14.6402
35	220	2.4	2272	1.1	19	0.9	0.94	0.03	0.91	0.03	0.025	0.003	13.699	0.183	*A15 mea* 13.8874 c=1.5: C
36	220	2.3	2911	1.1	24	1.3	0.96	0.03	0.96	0.03	0.020	0.003	17.241	0.204	*H15 mea* 13.8764 c=1.5: C
37	240	1.8	2657	1.2	26	1.5	0.94	0.02	0.94	0.02	0.018	0.002	14.615	0.173	*MAD* 1.14496
38	240	2.6	2462	1.2	26	1.4	0.95	0.02	0.93	0.02	0.018	0.002	11.165	0.112	*MADe* 1.69752
39	240	2.5	1794	1.3	22	1.1	0.97	0.03	0.97	0.03	0.020	0.002	10.839	0.132	*sMAD* 1.69752
40	240	2.5	2458	1.3	22	0.9	0.95	0.02	0.94	0.02	0.023	0.002	11.450	0.112	*H15 Std* 2.10885 c=1.5: C
41	260	2.8	2762	1.4	26	1.0	1.00	0.02	0.98	0.02	0.017	0.001	13.078	0.112	
42	260	2.7	2617	1.3	28	1.2	0.98	0.02	0.97	0.02	0.012	0.001	11.765	0.092	
43	260	2.6	2234	1.2	27	1.2	0.99	0.02	0.97	0.02	0.017	0.002	15.297	0.153	
44	260	3.1	2691	1.3	26	0.9	1.00	0.02	0.98	0.02	0.016	0.001	15.246	0.122	
45	280	1.7	2709	1.2	32	1.7	1.01	0.02	0.97	0.02	0.013	0.001	15.989	0.163	
46	280	1.7	2189	1.3	28	1.5	0.99	0.03	1.01	0.03	0.016	0.002	14.737	0.173	
47	280	1.6	2017	1.3	28	1.6	1.05	0.03	1.02	0.03	0.016	0.002	14.666	0.183	
48	280	2.0	2908	1.3	34	1.7	1.01	0.02	1.01	0.02	0.014	0.001	12.477	0.102	
													n =	16	n = 16
Mean		2.3	2465	1.2	25.6		0.98		0.97		0.018	Mean	13.895	Internal	H15 mean 13.876
SD		0.5	315	0.1	4.0		0.03		0.03		0.004	SD	1.895	Error	H15 Std Dev 2.109
SD/rtN		0.1	79	0.0	1.0		0.01		0.01		0.001	SD/rtN	0.474	0.039	SD/rtN 0.527
%err		5	3	2	4		1		1		6	%err	3		%err 4

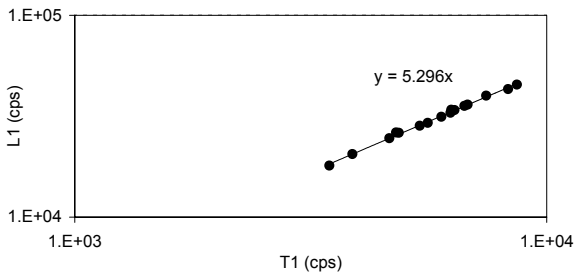


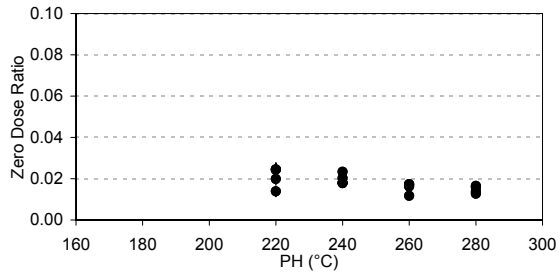


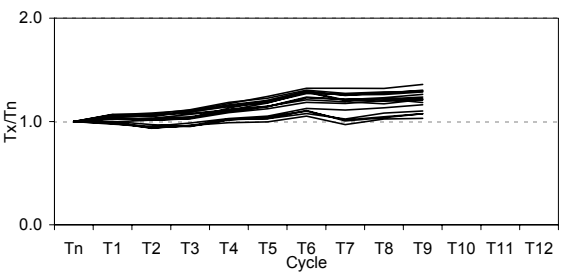












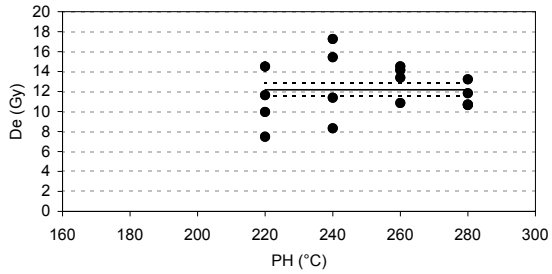
Sample SUTL 2102
Date 30407 to 60407
Reader Riso 1
Source Calibration 0.1022 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

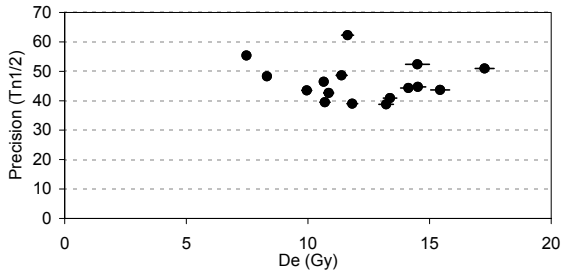
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.12	-0.01	3.05	9.19	12.25	15.32	-0.01	6.12	6.12

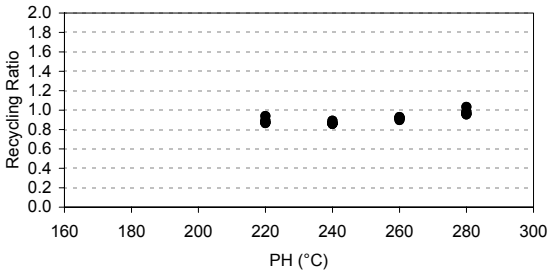
Test Dose (Gy) 1.01

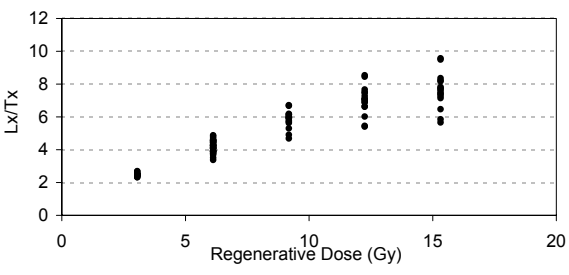
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

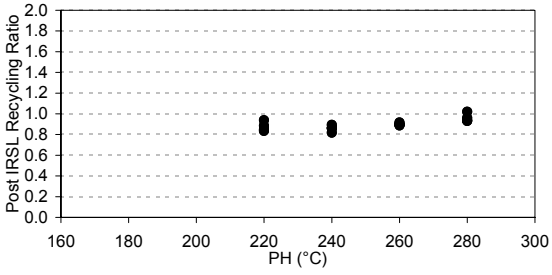
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.12 Gy		Post IRSL 6.12 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
1	220	1.7	2259	1.8	9	0.2	0.87	0.02	0.85	0.02	0.100	0.004	11.630	0.245	*Estimate*	*Estimate*	*Parame*
2	220	1.1	2470	1.9	8	0.2	0.87	0.03	0.83	0.03	0.118	0.006	14.502	0.491	*Median*	11.7271	
3	220	0.9	2083	1.5	14	0.7	0.94	0.04	0.94	0.04	0.069	0.005	9.954	0.204	*A15 mea*	12.1218	c=1.5: C
4	220	1.0	3031	1.7	9	0.3	0.89	0.03	0.88	0.03	0.132	0.006	7.471	0.143	*H15 mea*	12.1782	c=1.5: C
5	240	1.4	1647	1.9	13	0.5	0.89	0.03	0.89	0.03	0.088	0.004	8.319	0.153	*MAD*	1.71179	
6	240	1.8	1428	1.7	14	0.5	0.87	0.03	0.86	0.03	0.085	0.004	17.261	0.388	*MADe*	2.53791	
7	240	1.6	1181	1.6	14	0.7	0.86	0.03	0.86	0.03	0.084	0.005	15.432	0.388	*sMAD*	2.53791	
8	240	1.5	1561	1.8	13	0.5	0.86	0.03	0.82	0.03	0.084	0.004	11.385	0.225	*H15 Std*	2.71506	c=1.5: C
9	260	1.8	921	1.6	18	1.0	0.90	0.03	0.92	0.03	0.070	0.004	13.378	0.276			
10	260	1.6	1215	1.8	13	0.5	0.93	0.03	0.89	0.03	0.093	0.005	14.134	0.327			
11	260	1.2	1501	1.8	17	0.8	0.92	0.03	0.90	0.03	0.074	0.004	10.853	0.204			
12	260	1.8	1099	1.8	15	0.6	0.92	0.03	0.89	0.03	0.095	0.004	14.522	0.317			
13	280	0.8	2671	1.5	23	1.3	1.03	0.03	1.02	0.03	0.048	0.003	10.649	0.153			
14	280	1.4	1062	1.6	16	0.8	0.96	0.04	0.94	0.04	0.073	0.005	13.214	0.296			
15	280	1.0	1541	1.5	16	0.8	0.96	0.04	0.93	0.04	0.092	0.005	10.700	0.215			
16	280	1.3	1157	1.5	19	1.1	0.99	0.04	0.96	0.04	0.043	0.003	11.824	0.225			
													n =	16		n =	16
Mean		1.4	1677	1.7	14.4		0.91		0.90		0.084	Mean	12.202	Internal		H15 mean	12.178
SD		0.3	637	0.1	3.8		0.05		0.05		0.023	SD	2.620	Error		H15 Std Dev	2.715
SD/rtN		0.1	159	0.0	0.9		0.01		0.01		0.006	SD/rtN	0.655	0.070		SD/rtN	0.679
%err		6	10	2	7		1		1		7	%err	5			%err	6

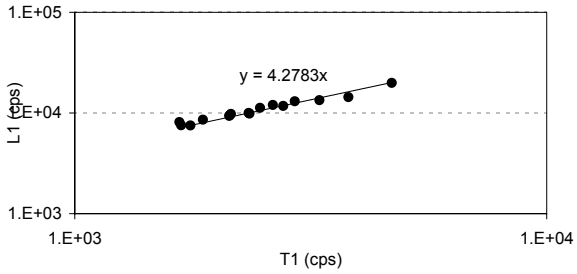


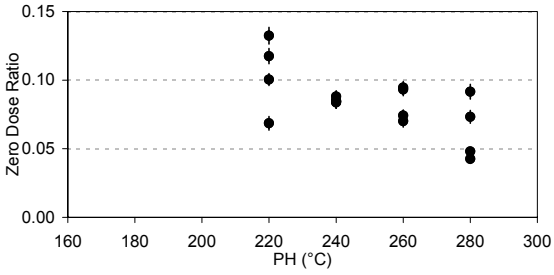


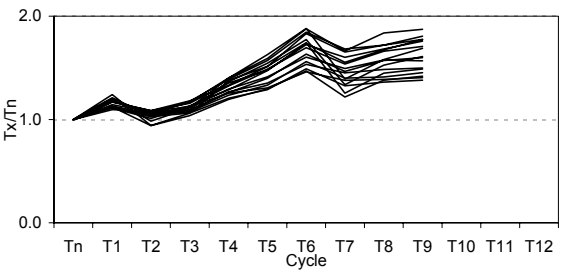












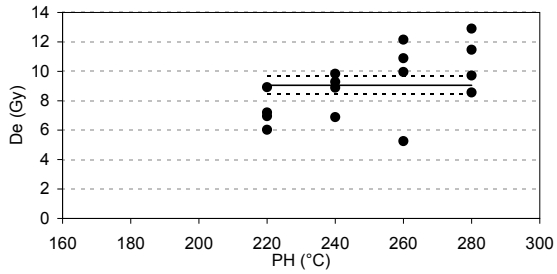
Sample SUTL 2103
Date 30407 to 60407
Reader Riso 1
Source Calibration 0.1022 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

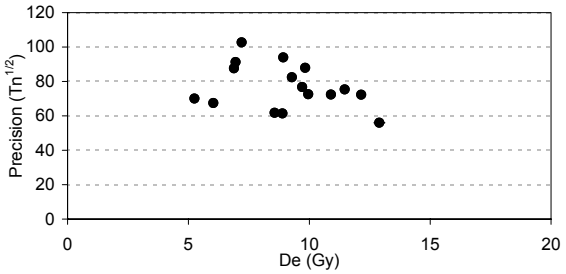
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.12	-0.01	3.05	9.19	12.25	15.32	-0.01	6.12	6.12

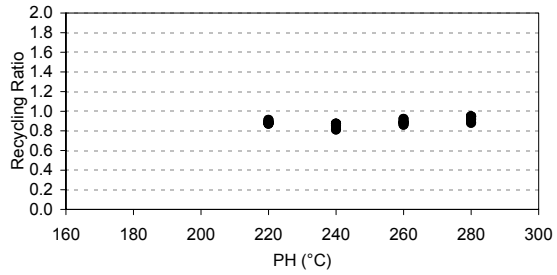
Test Dose (Gy) 1.01

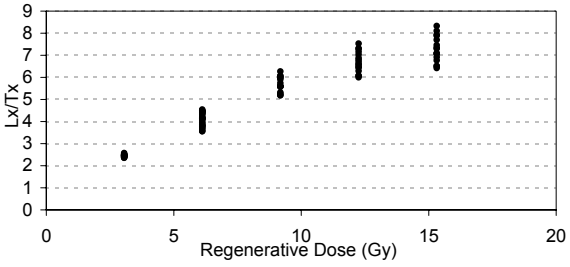
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

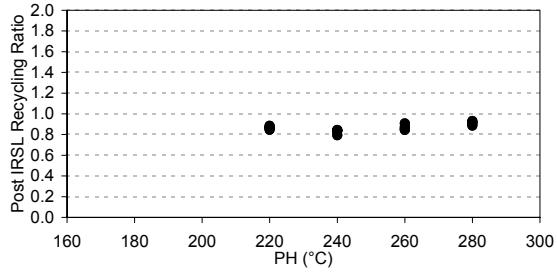
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.12 Gy		Post IRSL 6.12 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	2.1	2145	1.7	10	0.3	0.88	0.02	0.87	0.02	0.094	0.004	6.030	0.082	*Estimate*	*Estimate*	*Parame*
18	220	4.1	2547	1.8	10	0.2	0.89	0.01	0.86	0.01	0.101	0.003	7.205	0.072	*Median*	9.10061	
19	220	3.6	2426	1.7	11	0.2	0.91	0.02	0.88	0.02	0.097	0.003	8.922	0.092	*A15 mea*	9.05526	c=1.5: C
20	220	3.3	2498	1.7	11	0.2	0.87	0.02	0.84	0.02	0.087	0.003	6.949	0.072	*H15 mea*	9.05247	c=1.5: C
21	240	3.1	2169	1.8	13	0.3	0.87	0.02	0.84	0.02	0.093	0.003	9.279	0.102	*MAD*	1.84465	
22	240	3.7	2052	1.8	13	0.3	0.85	0.02	0.83	0.01	0.089	0.002	6.888	0.061	*MADe*	2.73488	
23	240	3.8	2014	1.9	12	0.2	0.87	0.02	0.84	0.01	0.092	0.002	9.831	0.102	*sMAD*	2.73488	
24	240	2.3	1623	1.9	13	0.4	0.81	0.02	0.79	0.02	0.096	0.003	8.891	0.133	*H15 Std*	2.40365	c=1.5: C
25	260	2.6	1869	2.0	17	0.4	0.92	0.02	0.91	0.02	0.077	0.002	5.253	0.051			
26	260	2.1	2466	1.8	13	0.3	0.89	0.02	0.85	0.02	0.091	0.003	10.894	0.133			
27	260	2.7	1913	1.7	14	0.3	0.88	0.02	0.87	0.02	0.085	0.003	12.151	0.143			
28	260	3.6	1446	2.1	11	0.2	0.86	0.02	0.84	0.02	0.119	0.003	9.954	0.133			
29	280	2.4	1295	1.6	15	0.5	0.88	0.02	0.89	0.02	0.116	0.004	12.897	0.215			
30	280	2.7	1398	1.7	17	0.6	0.95	0.02	0.92	0.02	0.085	0.003	8.564	0.102			
31	280	3.6	1559	1.7	15	0.4	0.92	0.02	0.91	0.02	0.080	0.002	11.466	0.123			
32	280	3.4	1714	1.8	15	0.4	0.95	0.02	0.93	0.02	0.086	0.002	9.709	0.092			
													n =	16		n =	16
Mean		3.1	1946	1.8	13.1		0.89		0.87		0.093	Mean	9.055	Internal		H15 mean	9.052
SD		0.7	413	0.1	2.2		0.03		0.04		0.012	SD	2.189	Error		H15 Std Dev	2.404
SD/rtN		0.2	103	0.0	0.6		0.01		0.01		0.003	SD/rtN	0.547	0.028		SD/rtN	0.601
%err		5	5	2	4		1		1		3	%err	6			%err	7

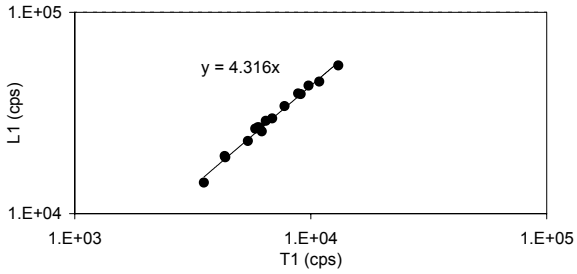


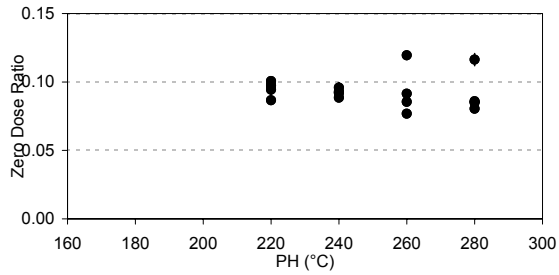


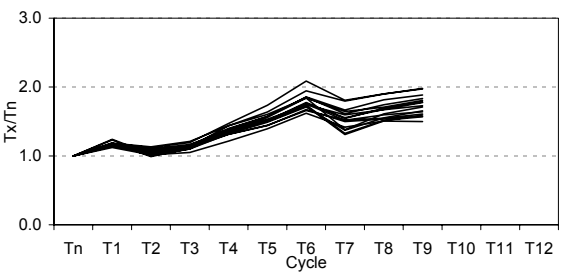












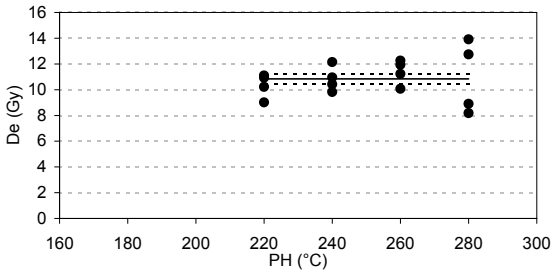
Sample SUTL 2104
Date 80307 to 110307
Reader Riso 1
Source Calibration 0.1024 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

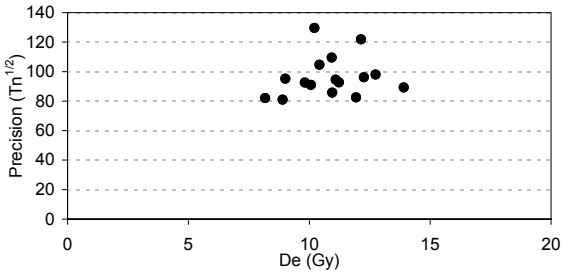
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.34	-0.01	6.13	6.13

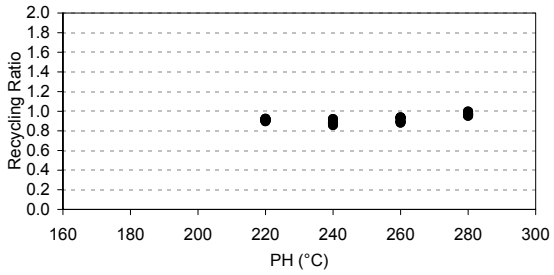
Test Dose (Gy) 1.01

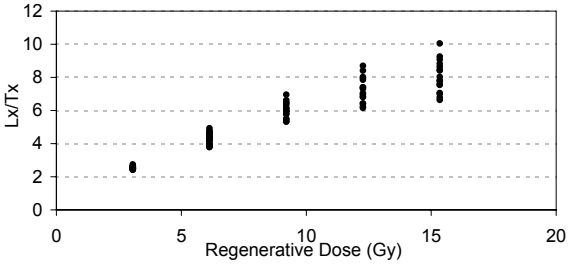
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

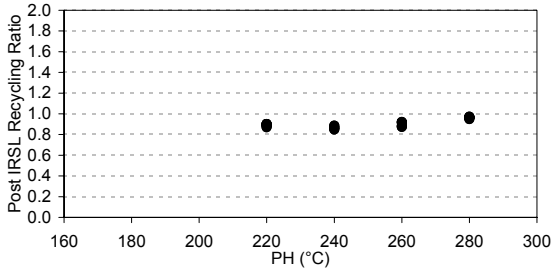
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.13 Gy		Post IRSL 6.13 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	7.1	2336	1.7	11	0.2	0.92	0.01	0.89	0.01	0.045	0.002	10.216	0.092	*Estimate*	*Estimate*	*Parame*
18	220	3.8	2357	1.8	10	0.2	0.90	0.02	0.87	0.02	0.048	0.003	9.008	0.113	*Median*	10.9424	
19	220	5.5	1605	1.7	11	0.2	0.92	0.02	0.90	0.02	0.046	0.003	11.096	0.143	*A15 mea*	10.8372	c=1.5: C
20	220	4.8	2467	1.7	10	0.2	0.90	0.02	0.90	0.02	0.048	0.002	10.932	0.123	*H15 mea*	10.8372	c=1.5: C
21	240	5.8	1862	1.7	13	0.3	0.89	0.01	0.86	0.01	0.044	0.002	10.420	0.102	*MAD*	1.05944	
22	240	6.5	2256	1.7	13	0.2	0.88	0.01	0.87	0.01	0.041	0.001	12.140	0.102	*MADe*	1.57073	
23	240	3.8	1910	1.7	14	0.3	0.86	0.02	0.85	0.02	0.037	0.002	10.953	0.123	*sMAD*	1.57073	
24	240	4.4	1925	1.6	15	0.4	0.92	0.02	0.89	0.02	0.033	0.002	9.816	0.092	*H15 Std*	1.55909	c=1.5: C
25	260	5.4	1693	1.9	15	0.3	0.88	0.01	0.87	0.01	0.044	0.002	12.263	0.113			
26	260	3.8	2152	1.6	20	0.5	0.93	0.02	0.92	0.02	0.030	0.001	10.072	0.082			
27	260	4.7	1805	1.7	17	0.4	0.94	0.02	0.91	0.02	0.039	0.002	11.229	0.102			
28	260	4.0	1679	1.8	15	0.3	0.90	0.02	0.88	0.02	0.039	0.002	11.935	0.133			
29	280	4.2	1873	1.6	17	0.4	0.95	0.02	0.95	0.02	0.037	0.001	13.911	0.133			
30	280	4.4	2156	1.5	22	0.6	0.97	0.01	0.96	0.01	0.021	0.001	12.744	0.092			
31	280	2.3	2890	1.7	19	0.5	1.00	0.02	0.97	0.02	0.027	0.001	8.179	0.072			
32	280	5.1	1268	1.6	19	0.5	0.96	0.02	0.97	0.02	0.037	0.002	8.895	0.082			
													n =	16		n =	16
Mean		4.7	2015	1.7	15.1		0.92		0.90		0.039	Mean	10.863	Internal		H15 mean	10.837
SD		1.2	395	0.1	3.7		0.04		0.04		0.008	SD	1.519	Error		H15 Std Dev	1.559
SD/rtN		0.3	99	0.0	0.9		0.01		0.01		0.002	SD/rtN	0.380	0.027		SD/rtN	0.390
%err		6	5	1	6		1		1		5	%err	3			%err	4

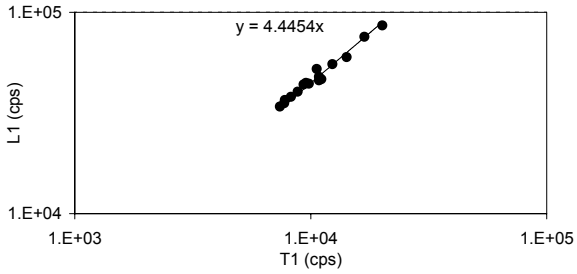


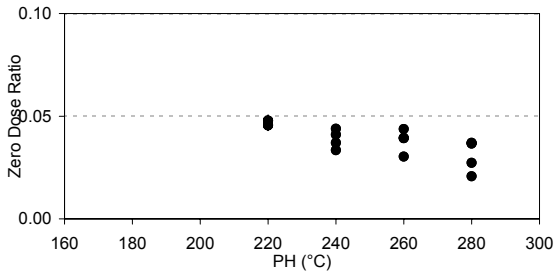


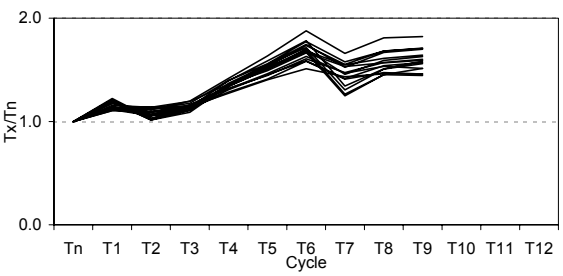












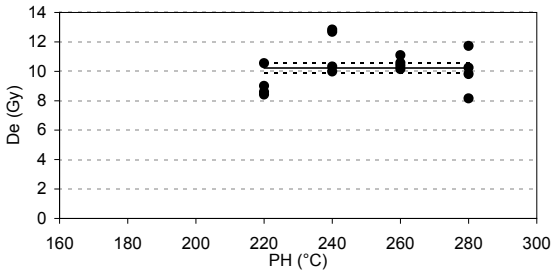
Sample SUTL 2105
Date 80307 to 110307
Reader Riso 1
Source Calibration 0.1024 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

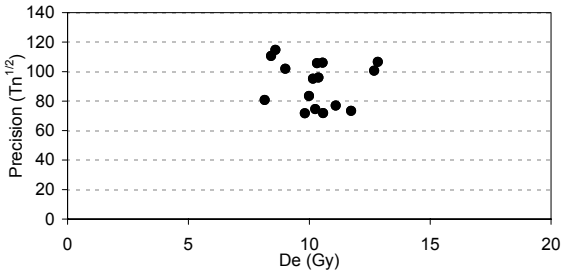
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.13	-0.01	3.06	9.20	12.27	15.34	-0.01	6.13	6.13

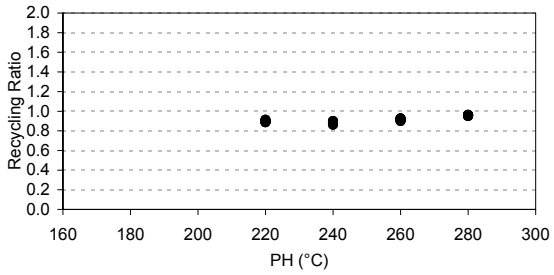
Test Dose (Gy) 1.01

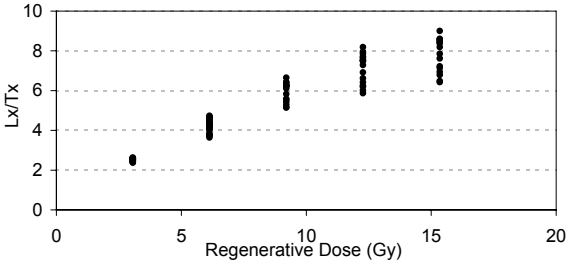
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

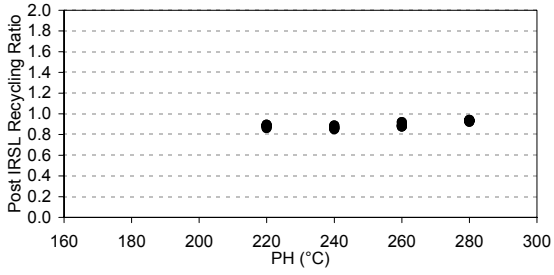
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.13 Gy		Post IRSL 6.13 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	4.4	2526	1.9	10	0.2	0.89	0.01	0.86	0.01	0.057	0.002	10.553	0.123	*Estimate*	*Estimate*	*Parame*
34	220	4.6	2627	1.8	10	0.2	0.90	0.01	0.89	0.01	0.048	0.002	8.424	0.082	*Median*	10.2822	
35	220	6.2	2096	1.8	10	0.2	0.91	0.01	0.88	0.01	0.054	0.002	8.598	0.082	*A15 mea*	10.2137	c=1.5: C
36	220	4.6	2229	1.7	11	0.2	0.89	0.02	0.88	0.02	0.048	0.002	9.008	0.092	*H15 mea*	10.2274	c=1.5: C
37	240	5.5	2005	1.9	13	0.2	0.86	0.01	0.85	0.01	0.050	0.002	10.318	0.092	*MAD*	0.63976	
38	240	4.7	2389	1.6	16	0.3	0.90	0.01	0.89	0.01	0.034	0.001	12.836	0.102	*MADe*	0.94851	
39	240	3.4	2022	1.7	13	0.3	0.88	0.02	0.87	0.02	0.040	0.002	9.990	0.113	*sMAD*	0.94851	
40	240	4.7	2127	1.8	12	0.2	0.88	0.01	0.86	0.01	0.049	0.002	12.683	0.133	*H15 Std*	1.42535	c=1.5: C
41	260	4.8	1896	1.8	16	0.3	0.90	0.01	0.88	0.01	0.034	0.001	10.379	0.082			
42	260	3.0	1698	1.8	17	0.5	0.93	0.02	0.92	0.02	0.033	0.002	10.574	0.113			
43	260	3.2	1825	1.8	16	0.4	0.92	0.02	0.89	0.02	0.033	0.002	11.096	0.113			
44	260	4.8	1865	1.7	15	0.3	0.90	0.01	0.88	0.01	0.039	0.002	10.154	0.092			
45	280	3.4	1563	1.7	14	0.4	0.95	0.02	0.93	0.02	0.045	0.002	11.731	0.133			
46	280	3.2	2014	1.7	18	0.4	0.95	0.02	0.94	0.02	0.036	0.002	8.158	0.072			
47	280	2.9	1895	1.7	16	0.4	0.96	0.02	0.93	0.02	0.034	0.002	10.246	0.102			
48	280	3.3	1542	1.6	18	0.5	0.96	0.02	0.92	0.02	0.030	0.002	9.816	0.102			
													n =	16		n =	16
Mean		4.2	2020	1.7	14.2		0.91		0.89		0.042	Mean	10.285	Internal		H15 mean	10.227
SD		1.0	312	0.1	2.9		0.03		0.03		0.008	SD	1.365	Error		H15 Std Dev	1.425
SD/rtN		0.2	78	0.0	0.7		0.01		0.01		0.002	SD/rtN	0.341	0.026		SD/rtN	0.356
%err		6	4	1	5		1		1		5	%err	3			%err	3

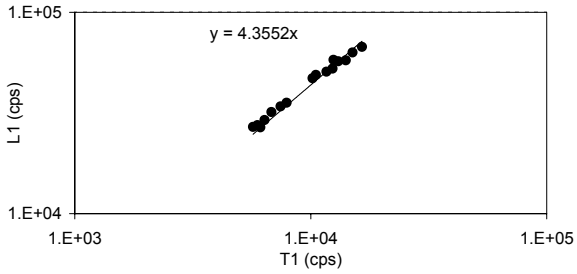


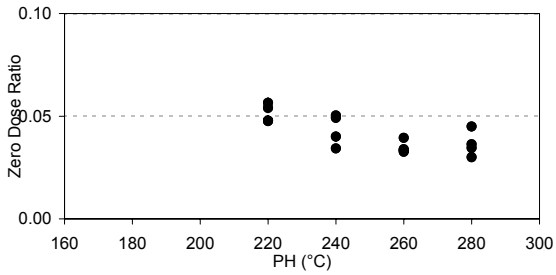


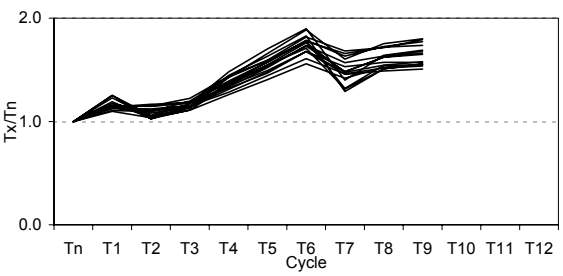












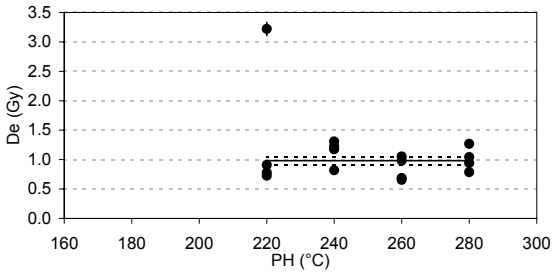
Sample SUTL 2106
Date 30407 to 60407
Reader Riso 1
Source Calibration 0.1022 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

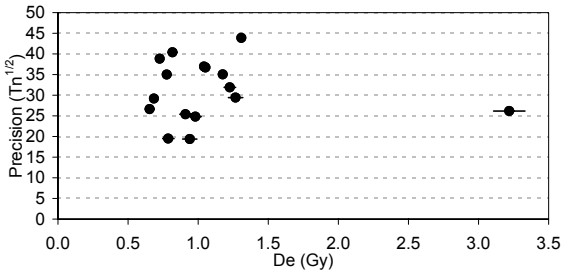
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.12	-0.01	3.05	9.19	12.25	15.32	-0.01	6.12	6.12

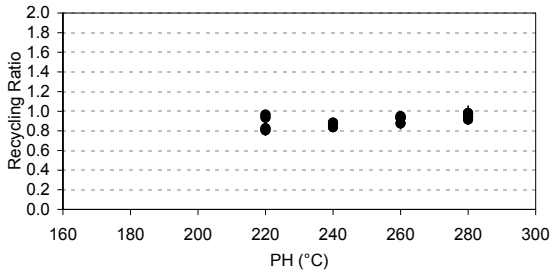
Test Dose (Gy) 1.01

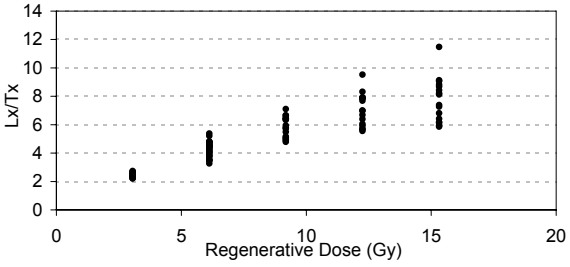
Measurement	Signal	Background
OSL 60s@125°C, 240CI	11-30	191-230
IRSL 120s@50°C, 240CI	11-30	191-230

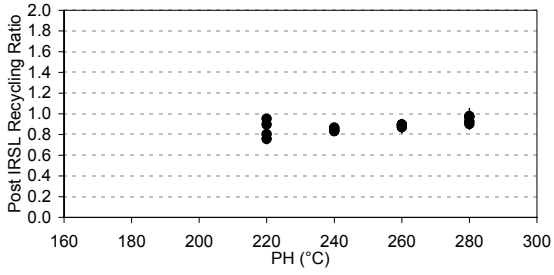
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.12 Gy		Post IRSL 6.12 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	0.6	1127	1.7	14	1.4	0.93	0.07	0.90	0.06	0.060	0.009	3.219	0.112	*Estimate*	*Estimate*	*Parame*
34	220	0.8	1865	2.1	10	0.4	0.96	0.04	0.95	0.04	0.081	0.006	0.726	0.020	*Median*	0.96065	
35	220	0.9	709	2.8	9	0.5	0.81	0.05	0.76	0.05	0.107	0.009	0.910	0.041	*A15 mea*	0.98451	c=1.5: C
36	220	0.7	1731	2.5	9	0.4	0.83	0.04	0.80	0.04	0.098	0.007	0.777	0.031	*H15 mea*	0.98218	c=1.5: C
37	240	0.2	8072	2.1	11	0.4	0.87	0.03	0.86	0.03	0.140	0.007	0.818	0.031	*MAD*	0.19928	
38	240	1.3	935	2.3	13	0.6	0.85	0.04	0.84	0.03	0.090	0.005	1.175	0.031	*MADe*	0.29546	
39	240	1.1	916	2.6	12	0.6	0.84	0.04	0.83	0.04	0.112	0.007	1.226	0.041	*sMAD*	0.29546	
40	240	1.3	1464	2.1	12	0.4	0.88	0.03	0.87	0.03	0.084	0.004	1.308	0.020	*H15 Std*	0.26453	c=1.5: C
41	260	1.4	602	2.2	14	0.8	0.95	0.05	0.90	0.04	0.066	0.005	0.685	0.020			
42	260	0.8	878	1.7	16	1.3	0.94	0.05	0.90	0.05	0.056	0.006	0.654	0.031			
43	260	0.5	1216	1.9	15	1.2	0.88	0.05	0.87	0.05	0.061	0.006	0.981	0.041			
44	260	1.2	1110	1.8	17	0.9	0.93	0.04	0.88	0.04	0.057	0.004	1.053	0.020			
45	280	1.0	1350	1.4	16	0.9	0.98	0.04	0.98	0.04	0.047	0.004	1.042	0.020			
46	280	1.2	713	2.2	12	0.6	0.91	0.04	0.90	0.04	0.139	0.009	1.267	0.051			
47	280	0.5	744	1.8	22	3.1	0.94	0.08	0.93	0.08	0.065	0.009	0.940	0.051			
48	280	1.1	341	1.5	35	7.7	0.97	0.08	0.97	0.08	0.022	0.007	0.787	0.041			
													n =	16		n =	16
Mean		0.9	1486	2.0	14.8		0.90		0.88		0.080	Mean	1.098	Internal		H15 mean	0.982
SD		0.3	1803	0.4	6.3		0.05		0.06		0.033	SD	0.603	Error		H15 Std Dev	0.265
SD/rtN		0.1	451	0.1	1.6		0.01		0.01		0.008	SD/rtN	0.151	0.011		SD/rtN	0.066
%err		9	30	5	11		2		2		10	%err	14			%err	7

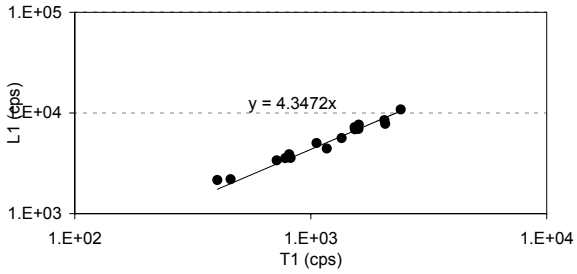


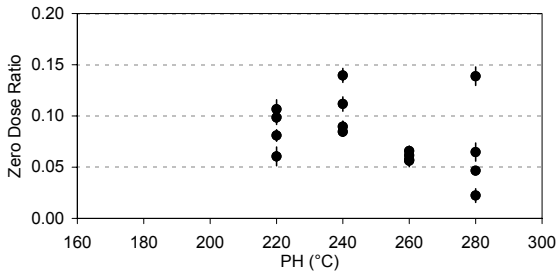


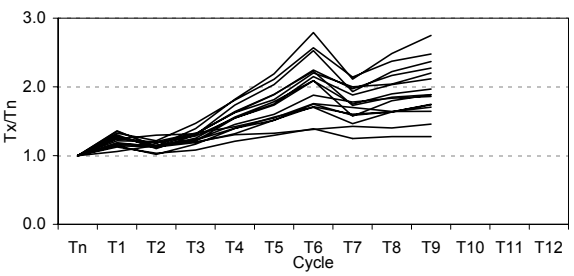












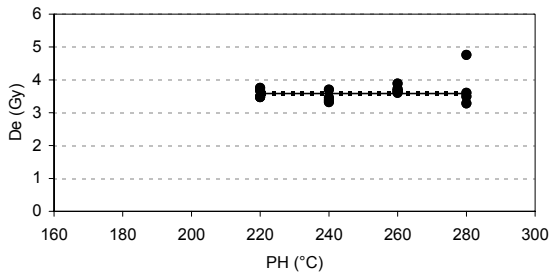
Sample SUTL 2214
Date 231107 to 271107
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

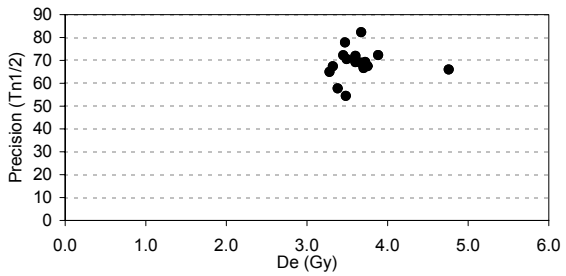
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.03	0.00	3.01	9.05	12.06	15.08	0.00	6.03	6.03

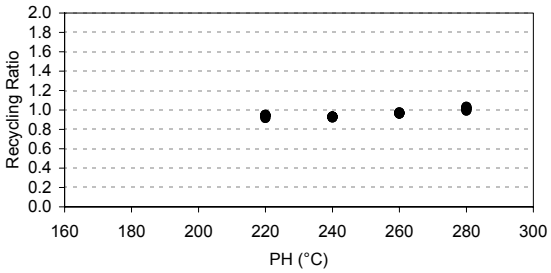
Test Dose (Gy) 1.00

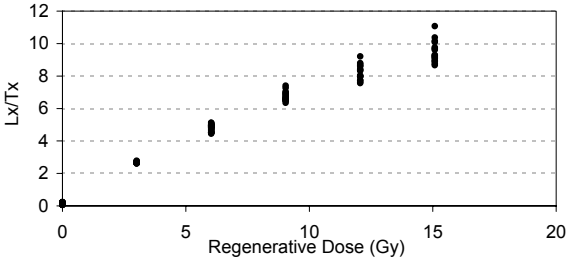
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

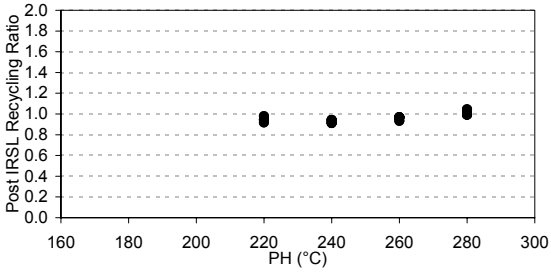
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.03 Gy		Post IRSL 6.03 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	3.3	2061	1.7	17	0.6	0.94	0.02	0.94	0.02	0.036	0.003	3.673	0.040	*Estimate*	*Estimate value*
2	220	4.1	1483	1.7	14	0.5	0.95	0.03	0.98	0.03	0.045	0.003	3.472	0.040	*Median*	3.6024
3	220	2.4	1906	1.6	14	0.6	0.92	0.03	0.92	0.03	0.048	0.004	3.753	0.050	*A15 mea*	3.58445
4	220	1.9	1568	1.6	15	0.8	0.94	0.04	0.95	0.04	0.044	0.005	3.482	0.050	*H15 mea*	3.58587
5	240	3.4	1341	1.9	16	0.6	0.92	0.03	0.92	0.02	0.045	0.003	3.321	0.040	*MAD*	0.12578
6	240	2.4	1394	1.7	17	0.8	0.93	0.03	0.94	0.03	0.039	0.004	3.381	0.050	*MADe*	0.18648
7	240	2.2	2026	1.9	15	0.5	0.93	0.03	0.91	0.02	0.047	0.003	3.703	0.040	*sMAD*	0.18648
8	240	2.6	2015	1.8	18	0.7	0.93	0.02	0.94	0.02	0.045	0.003	3.451	0.040	*H15 Std*	0.20875
9	260	2.9	1662	1.8	20	0.7	0.96	0.02	0.97	0.02	0.041	0.002	3.723	0.040		
10	260	3.2	1641	1.8	18	0.6	0.96	0.02	0.93	0.02	0.039	0.002	3.884	0.040		
11	260	3.4	1406	1.9	17	0.6	0.97	0.02	0.97	0.02	0.045	0.002	3.663	0.040		
12	260	2.9	1794	1.8	22	0.8	0.97	0.02	0.96	0.02	0.034	0.002	3.602	0.030		
13	280	3.3	1516	1.7	22	0.8	1.03	0.02	1.00	0.02	0.029	0.002	3.492	0.030		
14	280	2.8	1718	1.7	21	0.8	0.99	0.02	0.99	0.02	0.035	0.002	3.602	0.030		
15	280	1.3	3365	1.7	29	1.4	1.02	0.02	1.04	0.02	0.024	0.002	4.760	0.040		
16	280	2.2	1927	1.7	20	0.7	1.01	0.02	1.00	0.02	0.036	0.002	3.280	0.030		
													n =	16	n =	16
Mean		2.8	1801	1.7	18.3		0.96		0.96		0.039	Mean	3.640	Internal	H15 mean	3.586
SD		0.7	480	0.1	3.8		0.04		0.04		0.007	SD	0.342	Error	H15 Std Dev	0.209
SD/rtN		0.2	120	0.0	1.0		0.01		0.01		0.002	SD/rtN	0.085	0.010	SD/rtN	0.052
%err		6	7	1	5		1		1		4	%err	2		%err	1

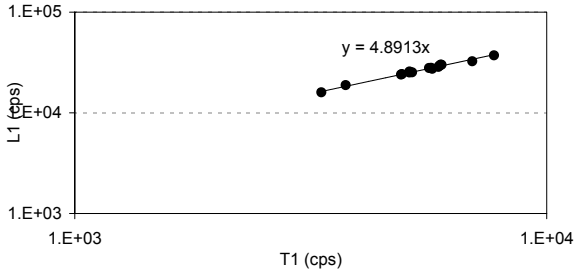


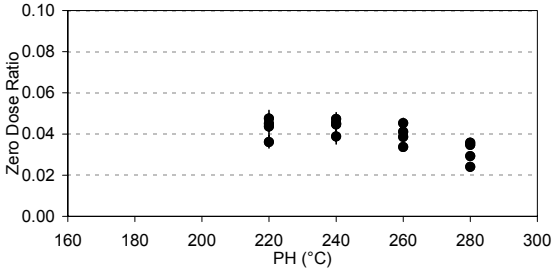


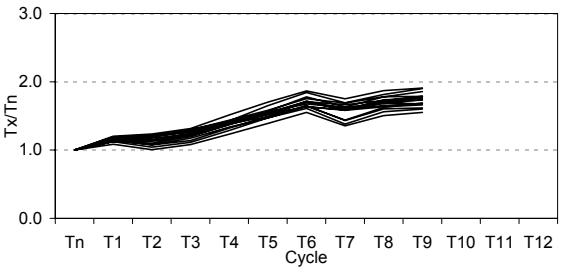










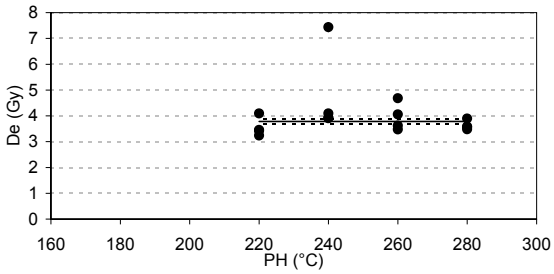


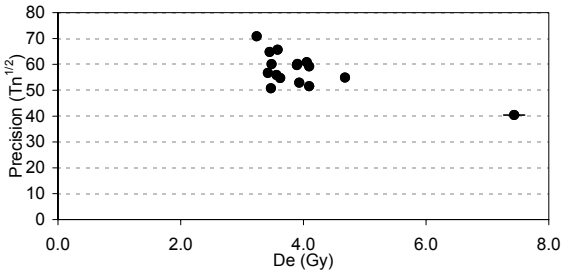
Sample SUTL 2215
Date 231107 to 271107
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

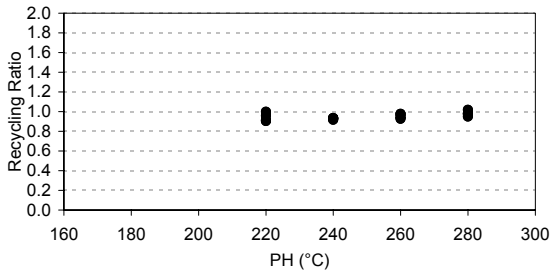
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.03	0.00	3.01	9.05	12.06	15.08	0.00	6.03	6.03

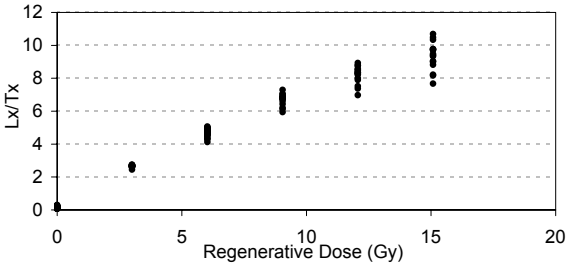
Test Dose (Gy) 1.00
Measurement Signal Background
OSL 60s@125°C, 240CI 11-30 191-230
IRSL 120s@50°C, 240CI 11-30 191-230

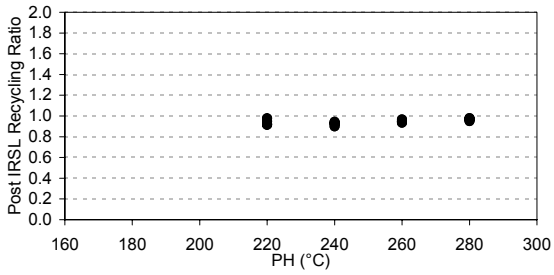
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.03 Gy		Post IRSL 6.03 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	2.4	2103	1.5	15	0.6	0.96	0.03	0.95	0.03	0.043	0.004	3.240	0.040	*Estimate*	*Estimate*	*Parame*
18	220	1.9	1405	1.6	16	1.0	1.00	0.04	0.98	0.04	0.034	0.005	4.095	0.070	*Median*	3.75837	
19	220	2.2	1469	1.6	12	0.6	0.90	0.03	0.92	0.03	0.050	0.005	3.421	0.050	*A15 mea*	3.78918	c=1.5: C
20	220	2.2	1916	1.7	13	0.5	0.91	0.03	0.92	0.03	0.068	0.005	3.451	0.050	*H15 mea*	3.78264	c=1.5: C
21	240	1.8	1959	1.7	19	0.9	0.92	0.03	0.93	0.03	0.039	0.003	4.095	0.050	*MAD*	0.29181	
22	240	2.0	1407	2.0	17	0.8	0.93	0.03	0.90	0.03	0.052	0.004	3.934	0.060	*MADe*	0.43265	
23	240	1.1	1491	1.8	14	0.8	0.93	0.04	0.94	0.04	0.059	0.006	7.436	0.171	*sMAD*	0.43265	
24	240	1.8	2020	1.6	18	0.9	0.93	0.03	0.92	0.03	0.030	0.003	3.904	0.050	*H15 Std*	0.3939	c=1.5: C
25	260	1.9	1583	1.8	19	0.9	0.97	0.03	0.95	0.03	0.038	0.003	3.623	0.050			
26	260	3.0	1239	1.7	19	0.8	0.94	0.03	0.95	0.03	0.046	0.003	4.055	0.050			
27	260	1.5	1724	1.8	21	1.2	0.93	0.03	0.94	0.03	0.043	0.003	3.472	0.050			
28	260	2.3	1316	1.9	28	1.8	0.98	0.03	0.97	0.03	0.031	0.003	4.679	0.060			
29	280	3.1	1396	1.6	21	0.8	0.98	0.02	0.97	0.02	0.040	0.002	3.582	0.040			
30	280	3.0	1209	1.7	23	1.1	0.98	0.03	0.97	0.03	0.034	0.002	3.482	0.040			
31	280	2.3	1363	1.7	19	0.8	0.95	0.03	0.95	0.03	0.044	0.003	3.562	0.040			
32	280	2.3	1558	1.6	24	1.2	1.02	0.03	0.98	0.03	0.024	0.002	3.894	0.040			
													n =	16		n =	16
Mean		2.2	1572	1.7	18.6		0.95		0.94		0.042	Mean	3.995	Internal		H15 mean	3.783
SD		0.5	286	0.1	4.2		0.03		0.02		0.011	SD	0.986	Error		H15 Std Dev	0.394
SD/rtN		0.1	72	0.0	1.1		0.01		0.01		0.003	SD/rtN	0.247	0.016		SD/rtN	0.098
%err		6	5	2	6		1		1		7	%err	6			%err	3

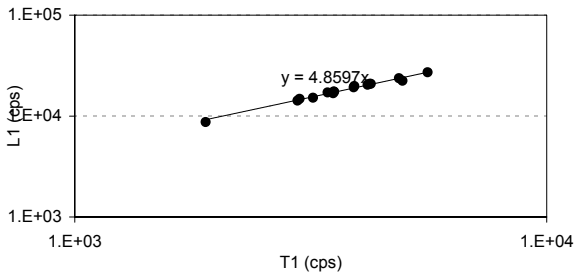


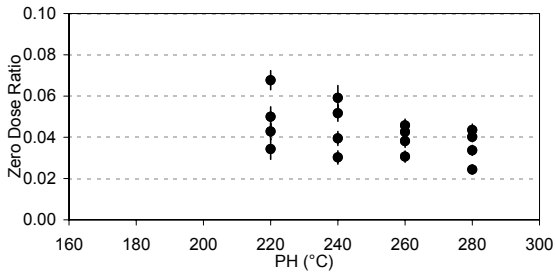


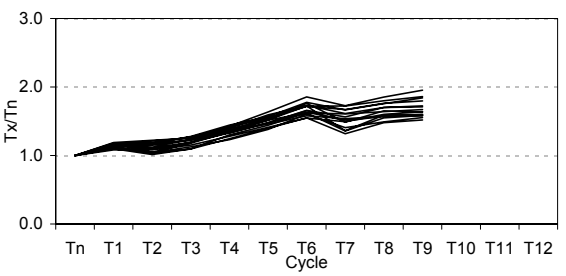












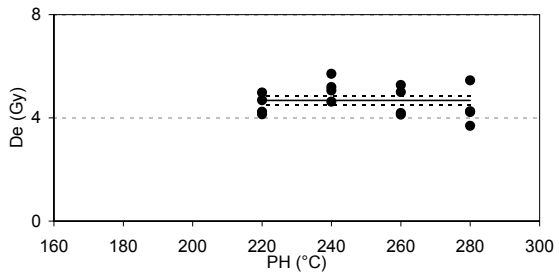
Sample SUTL 2216
Date 231107 to 271107
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

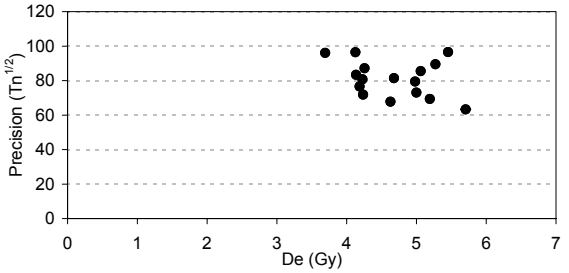
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.03	0.00	3.01	9.05	12.06	15.08	0.00	6.03	6.03

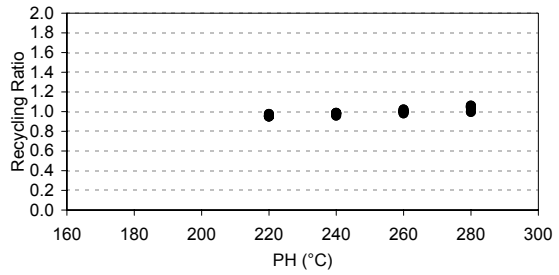
Test Dose (Gy) 1.00

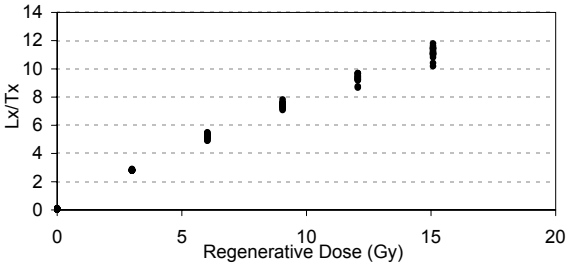
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

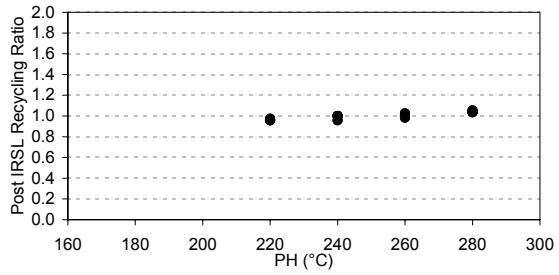
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.03 Gy		Post IRSL 6.03 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	2.5	2072	1.2	26	1.8	0.95	0.03	0.96	0.03	0.013	0.003	4.236	0.050	*Estimate*	*Estimate*	*Parame*
34	220	2.8	2493	1.3	22	1.1	0.97	0.02	0.97	0.02	0.015	0.003	4.136	0.040	*Median*	4.65394	
35	220	2.4	2776	1.3	19	0.9	0.96	0.03	0.96	0.03	0.022	0.003	4.679	0.050	*A15 mea*	4.67373	c=1.5: C
36	220	2.6	2441	1.3	21	1.0	0.95	0.02	0.96	0.03	0.025	0.003	4.981	0.050	*H15 mea*	4.67407	c=1.5: C
37	240	2.1	1916	1.4	31	2.5	0.99	0.03	1.00	0.03	0.014	0.003	5.705	0.070	*MAD*	0.44778	
38	240	3.2	2294	1.4	25	1.1	0.96	0.02	0.96	0.02	0.013	0.002	5.061	0.040	*MADe*	0.66389	
39	240	2.5	1846	1.4	23	1.2	0.98	0.03	1.00	0.03	0.018	0.002	4.629	0.050	*sMAD*	0.66389	
40	240	2.4	2011	1.4	31	2.1	0.98	0.03	1.00	0.03	0.011	0.002	5.192	0.050	*H15 Std*	0.63305	c=1.5: C
41	260	2.3	2333	1.4	27	1.2	0.98	0.02	1.00	0.02	0.015	0.002	5.001	0.040			
42	260	3.0	3112	1.4	29	1.2	1.00	0.02	1.01	0.02	0.018	0.001	4.126	0.030			
43	260	2.1	3827	1.4	28	1.1	1.00	0.02	0.98	0.02	0.014	0.001	5.273	0.040			
44	260	2.4	2454	1.4	27	1.3	1.02	0.02	1.03	0.02	0.014	0.002	4.186	0.040			
45	280	3.4	2755	1.3	30	1.1	1.06	0.02	1.04	0.02	0.009	0.001	5.454	0.030			
46	280	2.8	2728	1.4	26	0.9	1.04	0.02	1.04	0.02	0.012	0.001	4.256	0.030			
47	280	3.4	2728	1.5	32	1.2	1.05	0.02	1.05	0.02	0.009	0.001	3.693	0.020			
48	280	2.4	2731	1.5	34	1.6	1.00	0.02	1.04	0.02	0.011	0.001	4.226	0.030			
													n =	16		n =	16
Mean		2.6	2532	1.4	26.9		0.99		1.00		0.015	Mean	4.677	Internal		H15 mean	4.674
SD		0.4	496	0.1	4.2		0.03		0.03		0.004	SD	0.578	Error		H15 Std Dev	0.633
SD/rtN		0.1	124	0.0	1.0		0.01		0.01		0.001	SD/rtN	0.144	0.011		SD/rtN	0.158
%err		4	5	1	4		1		1		8	%err	3			%err	3

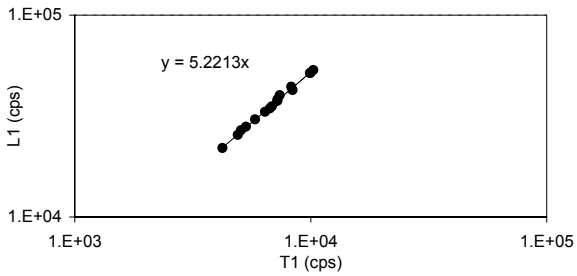


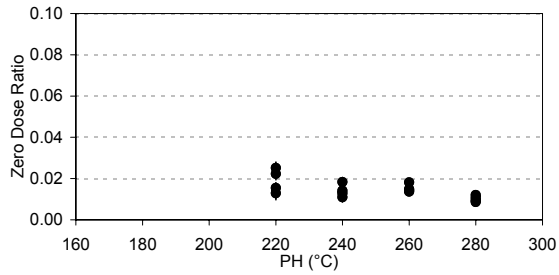


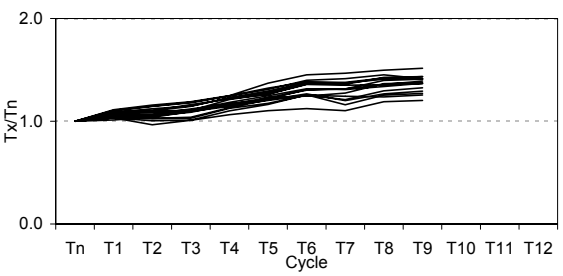












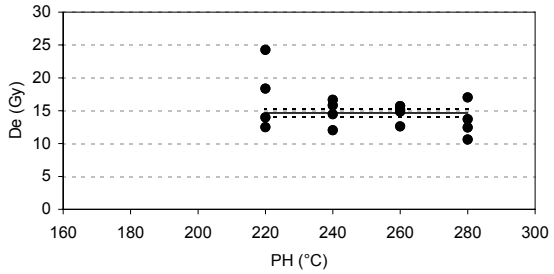
Sample SUTL 2217
Date 261107 to 301107
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

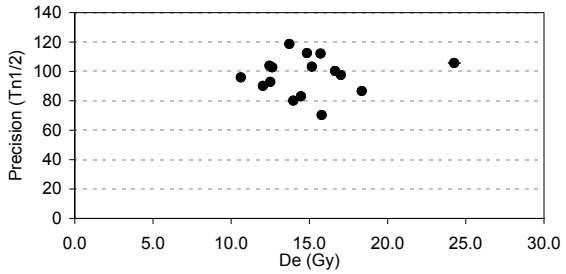
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.44	11.24	14.05	0.02	5.63	5.63

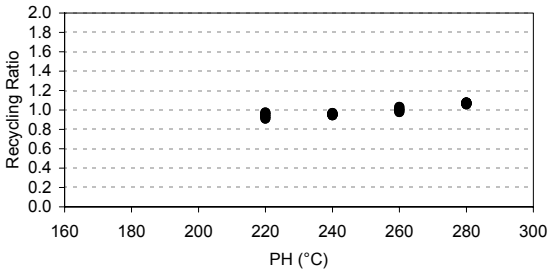
Test Dose (Gy) 0.96

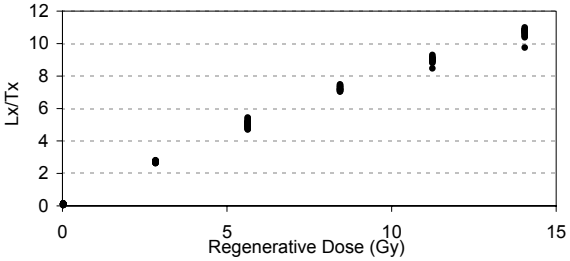
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

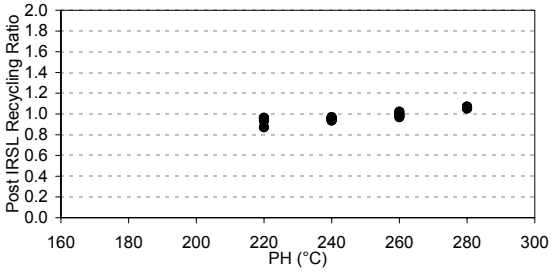
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	3.9	2992	1.0	20	0.9	0.97	0.02	0.96	0.02	0.021	0.003	24.263	0.374	*Estimate*	*Estimate value*
2	220	2.9	2704	1.1	20	1.2	0.93	0.03	0.93	0.03	0.015	0.003	18.354	0.280	*Median*	14.656
3	220	3.4	1974	1.2	15	0.8	0.91	0.03	0.87	0.03	0.029	0.004	13.978	0.252	*A15 mea*	14.6921
4	220	3.2	2812	1.1	22	1.3	0.96	0.03	0.95	0.03	0.016	0.003	12.501	0.150	*H15 mea*	14.6654
5	240	3.7	2296	1.3	23	1.2	0.97	0.02	0.97	0.02	0.025	0.002	12.033	0.131	*MAD*	2.01491
6	240	5.4	1944	1.2	22	0.9	0.95	0.02	0.94	0.02	0.022	0.002	16.652	0.187	*MADe*	2.9873
7	240	3.3	2184	1.3	22	1.2	0.95	0.02	0.94	0.02	0.029	0.003	14.464	0.187	*sMAD*	2.9873
8	240	7.3	707	1.2	23	1.7	0.96	0.03	0.96	0.03	0.020	0.003	15.792	0.262	*H15 Std*	2.53884
9	260	6.2	2118	1.4	23	0.8	0.98	0.02	0.97	0.02	0.027	0.001	15.717	0.131		
10	260	4.4	2509	1.5	26	1.0	1.01	0.02	1.00	0.02	0.021	0.002	12.622	0.103		
11	260	4.6	2421	1.4	27	1.1	1.00	0.02	0.98	0.02	0.027	0.002	15.166	0.122		
12	260	4.3	3070	1.4	27	1.0	1.03	0.02	1.02	0.02	0.017	0.001	14.848	0.112		
13	280	4.1	3585	1.6	33	1.2	1.06	0.01	1.06	0.01	0.024	0.001	13.716	0.084		
14	280	4.0	2482	1.4	33	1.6	1.08	0.02	1.06	0.02	0.025	0.002	17.017	0.131		
15	280	4.5	2505	1.4	35	1.6	1.07	0.02	1.07	0.02	0.024	0.001	12.454	0.084		
16	280	3.7	2595	1.4	37	2.0	1.06	0.02	1.05	0.02	0.024	0.002	10.621	0.075		
													n =	16	n =	16
Mean		4.3	2431	1.3	25.5		0.99		0.98		0.023	Mean	15.012	Internal	H15 mean	14.665
SD		1.2	628	0.2	6.2		0.05		0.06		0.004	SD	3.208	Error	H15 Std Dev	2.539
SD/rtN		0.3	157	0.0	1.5		0.01		0.01		0.001	SD/rtN	0.802	0.046	SD/rtN	0.635
%err		7	6	3	6		1		1		5	%err	5		%err	4

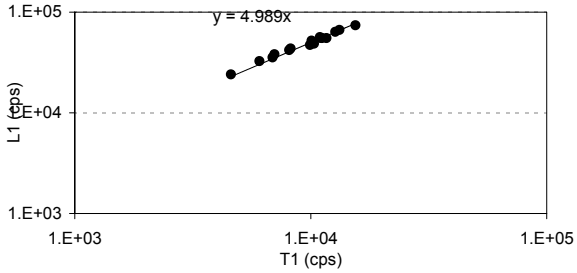


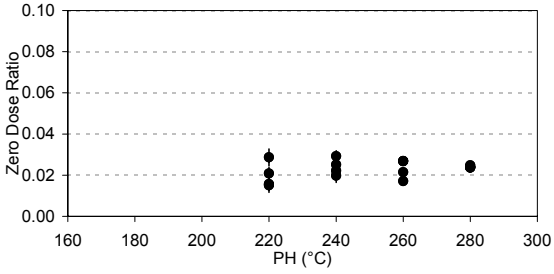


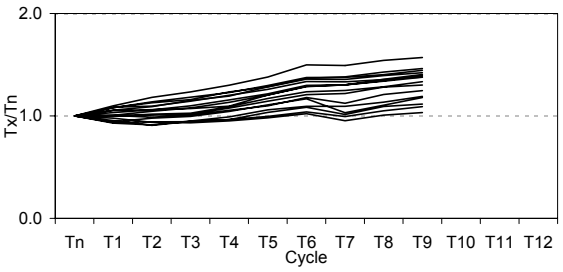












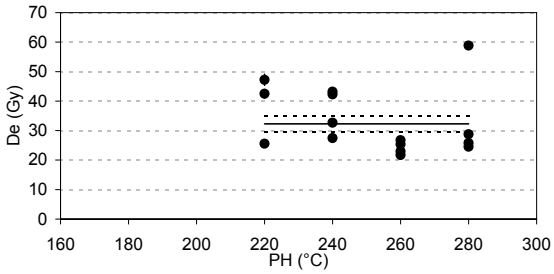
Sample SUTL 2218
Date 261107 to 301107
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

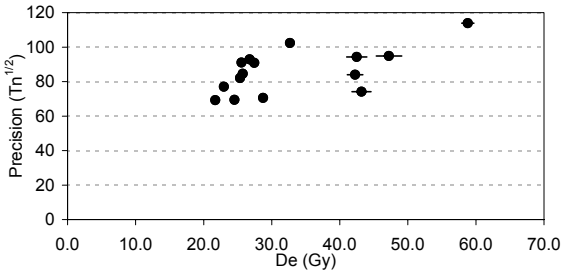
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.44	11.24	14.05	0.02	5.63	5.63

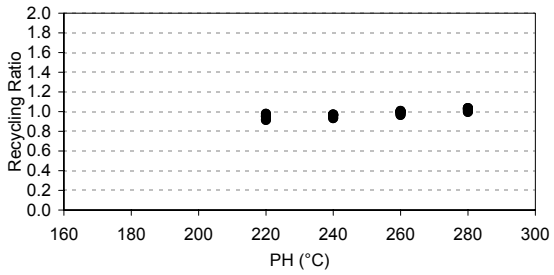
Test Dose (Gy) 0.96

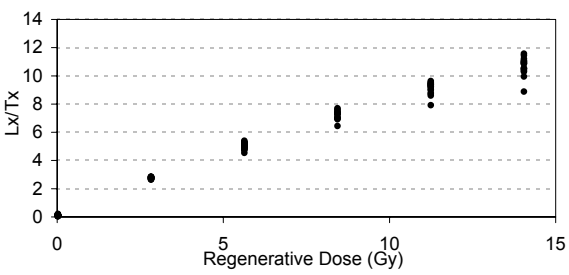
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

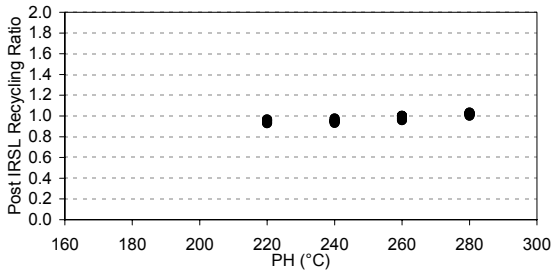
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	3.7	2540	1.0	19	1.0	0.95	0.03	0.97	0.03	0.027	0.004	47.226	1.879	*Estimate*	*Estimate*	*Parame*
18	220	2.9	2984	1.0	19	1.1	0.92	0.03	0.93	0.03	0.026	0.003	25.563	0.505	*Median*	27.4326	
19	220	3.1	3060	1.1	0	0.0	0.95	0.03	0.94	0.03	0.045	0.004			*A15 mea*	29.8829	c=1.5: C
20	220	3.5	2654	1.0	19	0.9	0.98	0.03	0.95	0.03	0.022	0.003	42.495	1.477	*H15 mea*	32.2966	c=1.5: C
21	240	4.1	1401	1.0	22	1.4	0.96	0.03	0.98	0.03	0.025	0.003	43.187	1.393	*MAD*	4.45991	
22	240	3.6	2049	1.0	23	1.3	0.93	0.03	0.93	0.03	0.021	0.003	42.252	1.141	*MADe*	6.61226	
23	240	2.3	3747	1.1	25	1.4	0.97	0.02	0.95	0.02	0.019	0.002	27.433	0.421	*sMAD*	6.61226	
24	240	4.7	2329	1.1	22	1.0	0.97	0.02	0.95	0.02	0.034	0.002	32.687	0.580	*H15 Std*	10.7007	c=1.5: C
25	260	4.1	2197	1.1	27	1.4	0.99	0.02	0.98	0.02	0.022	0.002	26.750	0.355			
26	260	3.5	2009	1.1	30	1.9	1.00	0.03	1.00	0.03	0.021	0.002	25.348	0.365			
27	260	3.0	1667	1.1	29	2.3	1.01	0.03	1.00	0.03	0.012	0.003	21.710	0.346			
28	260	2.5	2481	1.2	24	1.2	0.97	0.02	0.96	0.02	0.026	0.002	22.973	0.318			
29	280	3.9	1916	1.2	37	2.2	1.04	0.02	1.02	0.02	0.024	0.002	25.750	0.271			
30	280	2.5	2080	1.1	27	1.7	1.00	0.03	1.00	0.03	0.032	0.003	28.742	0.467			
31	280	2.1	2395	1.0	35	2.8	1.02	0.03	1.03	0.03	0.023	0.002	24.534	0.318			
32	280	4.0	3387	1.2	31	1.2	1.03	0.02	1.02	0.02	0.017	0.001	58.802	0.888			
													n =	15		n =	15
Mean		3.4	2389	1.1	26.0		0.98		0.98		0.023	Mean	33.030	Internal		H15 mean	32.297
SD		0.8	622	0.1	5.6		0.03		0.03		0.005	SD	11.026	Error		H15 Std Dev	10.701
SD/rtN		0.2	161	0.0	1.4		0.01		0.01		0.001	SD/rtN	2.847	0.225		SD/rtN	2.763
%err		6	7	2	6		1		1		6	%err	9			%err	9

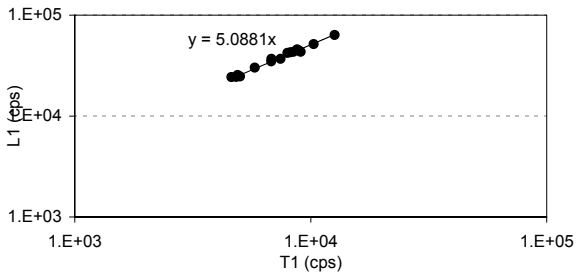


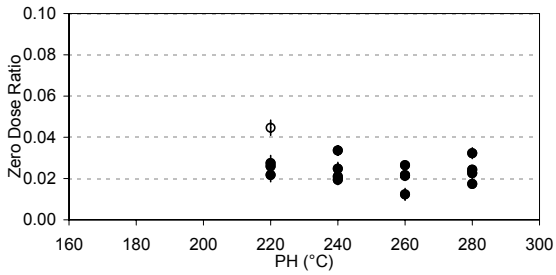


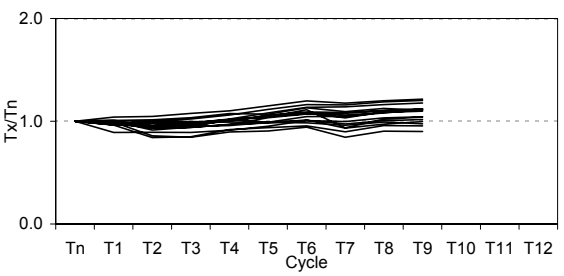












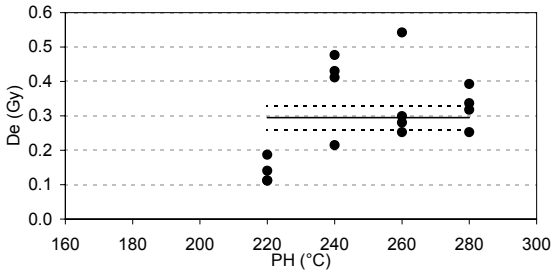
Sample SUTL 2219
Date 261107 to 301107
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

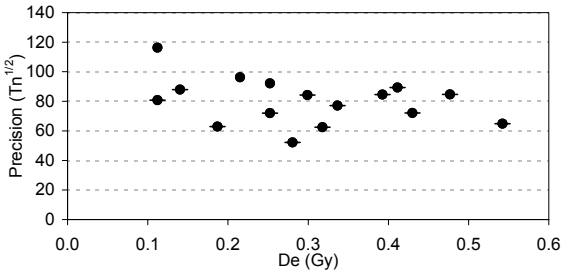
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.44	11.24	14.05	0.02	5.63	5.63

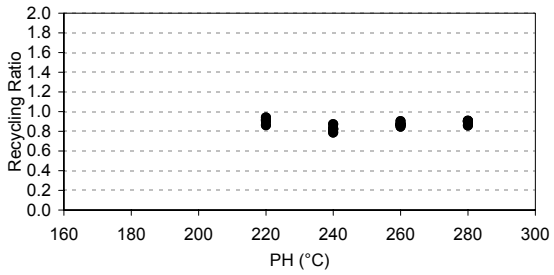
Test Dose (Gy) 0.96

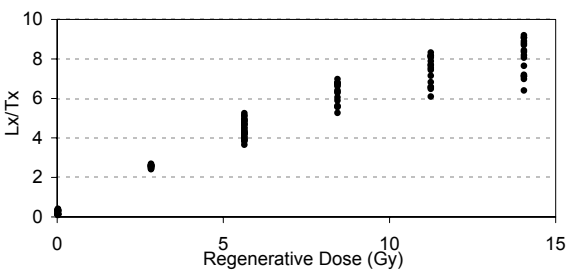
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

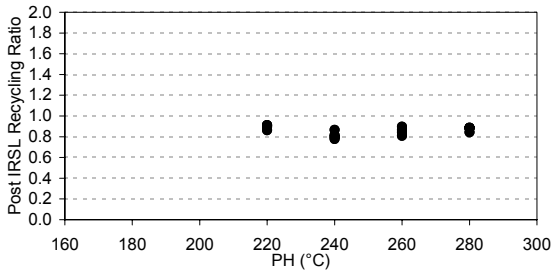
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	1.9	3587	1.6	10	0.2	0.94	0.02	0.91	0.02	0.082	0.004	0.112	0.009	*Estimate*	*Estimate*	*Paramet*
34	220	3.9	3621	1.7	10	0.2	0.91	0.01	0.90	0.01	0.083	0.002	0.112	0.000	*Median*	0.28985	
35	220	3.2	2522	1.6	11	0.3	0.92	0.02	0.91	0.02	0.080	0.003	0.140	0.009	*A15 mea*	0.29596	c=1.5: C
36	220	1.9	2177	2.3	9	0.2	0.86	0.02	0.86	0.02	0.097	0.004	0.187	0.009	*H15 mea*	0.29474	c=1.5: C
37	240	2.6	2086	2.1	10	0.3	0.82	0.02	0.80	0.02	0.078	0.003	0.430	0.009	*MAD*	0.10285	
38	240	3.3	2270	2.0	15	0.4	0.83	0.01	0.81	0.01	0.055	0.002	0.477	0.009	*MADe*	0.15248	
39	240	4.5	1854	2.1	13	0.3	0.79	0.01	0.78	0.01	0.063	0.002	0.411	0.009	*sMAD*	0.15248	
40	240	3.4	2846	1.7	14	0.3	0.87	0.01	0.87	0.01	0.062	0.002	0.215	0.000	*H15 Std*	0.14065	c=1.5: C
41	260	3.9	2276	2.0	17	0.4	0.90	0.01	0.90	0.01	0.055	0.001	0.252	0.000			
42	260	1.8	1583	1.9	16	0.7	0.87	0.03	0.87	0.02	0.061	0.003	0.280	0.009			
43	260	2.9	1513	2.2	12	0.3	0.85	0.02	0.81	0.02	0.081	0.003	0.542	0.009			
44	260	3.6	2058	2.0	14	0.3	0.87	0.01	0.84	0.01	0.071	0.002	0.299	0.009			
45	280	2.8	1458	2.0	15	0.4	0.90	0.02	0.88	0.02	0.069	0.002	0.318	0.009			
46	280	3.7	2021	1.8	16	0.4	0.86	0.01	0.84	0.01	0.048	0.001	0.393	0.009			
47	280	2.9	1866	1.8	16	0.4	0.91	0.02	0.88	0.02	0.047	0.002	0.252	0.009			
48	280	3.6	1726	1.7	16	0.4	0.90	0.02	0.89	0.02	0.059	0.002	0.337	0.009			
													n =	16		n =	16
Mean		3.1	2217	1.9	13.4		0.87		0.86		0.068	Mean	0.297	Internal		H15 mean	0.295
SD		0.8	653	0.2	2.8		0.04		0.04		0.014	SD	0.129	Error		H15 Std Dev	0.141
SD/rtN		0.2	163	0.1	0.7		0.01		0.01		0.004	SD/rtN	0.032	0.002		SD/rtN	0.035
%err		6	7	3	5		1		1		5	%err	11			%err	12

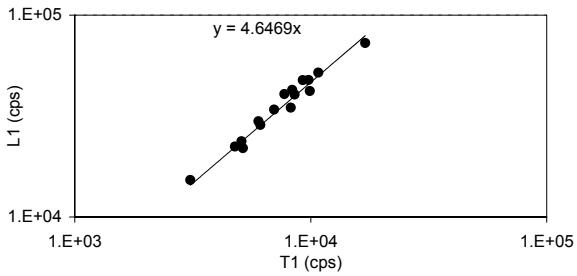


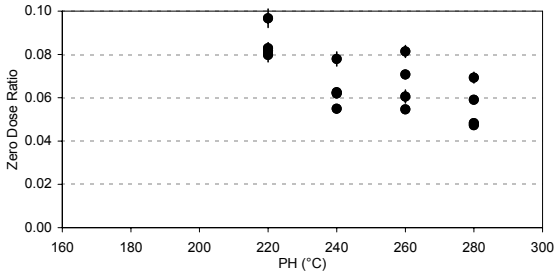


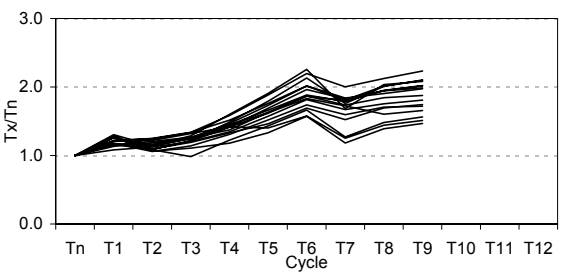












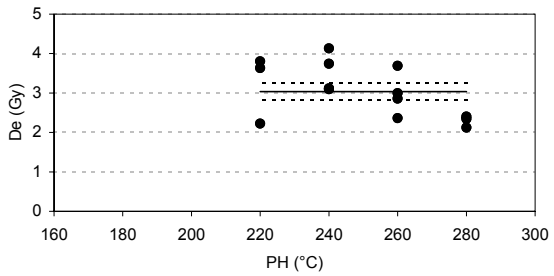
Sample SUTL 2220
Date 31207 to 71207
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

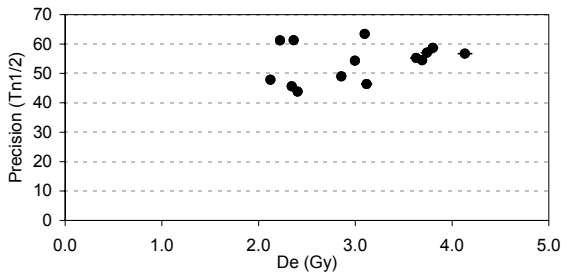
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.02	0.00	3.01	9.04	12.06	15.07	0.00	6.02	6.02

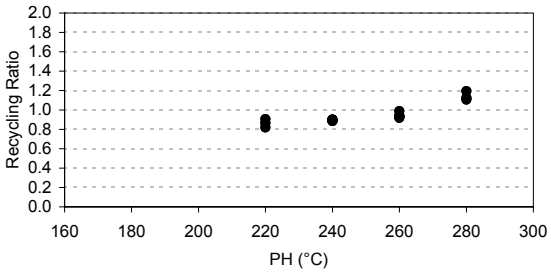
Test Dose (Gy) 0.99

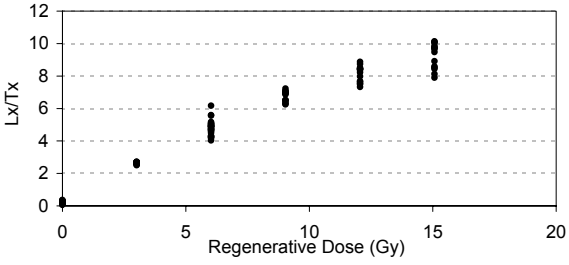
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

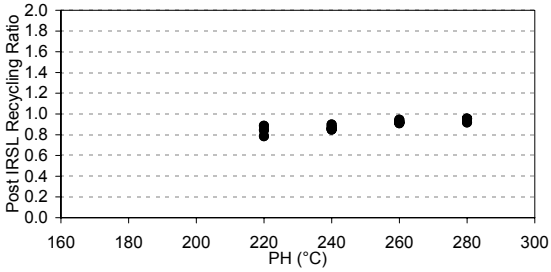
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.02 Gy		Post IRSL 6.02 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	3.8	807	1.9	15	0.6	0.91	0.03	0.89	0.03	0.067	0.003	3.631	0.060	*Estimate*	*Estimate value*
2	220	4.8													*Median*	3.04727
3	220	3.7	1018	2.0	13	0.4	0.82	0.02	0.79	0.02	0.074	0.003	2.223	0.030	*A15 mea*	3.03721
4	220	3.2	1081	1.9	16	0.6	0.86	0.02	0.84	0.02	0.062	0.003	3.802	0.050	*H15 mea*	3.03721
5	240	3.7	884	1.7	15	0.6	0.90	0.03	0.87	0.03	0.068	0.004	3.741	0.060	*MAD*	0.66376
6	240	2.9	1114	1.6	17	0.8	0.89	0.03	0.85	0.03	0.058	0.004	4.133	0.070	*MADe*	0.98409
7	240	2.6	832	1.9	16	0.7	0.90	0.03	0.90	0.03	0.058	0.003	3.118	0.050	*sMAD*	0.98409
8	240	4.5	898	1.7	20	0.9	0.89	0.03	0.85	0.02	0.046	0.003	3.098	0.040	*H15 Std*	0.76636
9	260	4.0	746	1.6	19	0.8	0.94	0.03	0.93	0.03	0.044	0.002	3.691	0.040		
10	260	4.1	589	1.7	20	1.0	0.92	0.03	0.91	0.03	0.042	0.003	2.856	0.040		
11	260	4.0	742	1.5	21	0.9	0.93	0.03	0.92	0.03	0.050	0.003	2.997	0.040		
12	260	3.4	1110	1.8	20	0.7	0.99	0.02	0.94	0.02	0.044	0.002	2.363	0.030		
13	280	3.5	658	1.4	16	0.7	1.19	0.04	0.92	0.03	0.034	0.003	2.122	0.030		
14	280	4.1	510	1.3	18	1.0	1.12	0.04	0.95	0.03	0.043	0.003	2.343	0.030		
15	280	3.9														
16	280	3.3	586	1.4	18	1.0	1.11	0.04	0.95	0.03	0.039	0.003	2.404	0.040		
													n =	14	n =	14
Mean		3.6	827	1.7	17.5		0.95		0.89		0.052	Mean	3.037	Internal	H15 mean	3.037
SD		0.5	202	0.2	2.3		0.11		0.05		0.012	SD	0.676	Error	H15 Std Dev	0.766
SD/rtN		0.1	54	0.1	0.6		0.03		0.01		0.003	SD/rtN	0.181	0.012	SD/rtN	0.205
%err		4	7	3	4		3		1		6	%err	6		%err	7

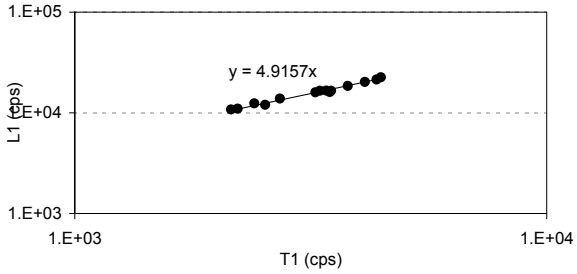


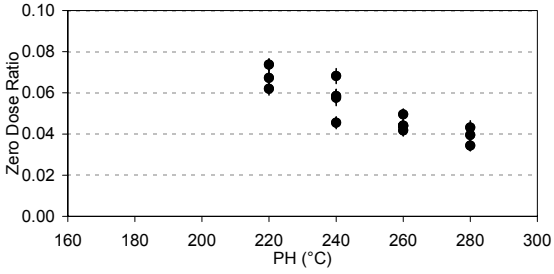


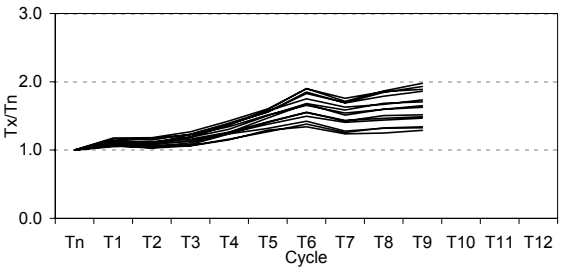












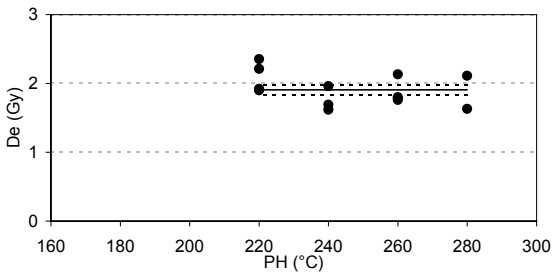
Sample SUTL 2221
Date 31207 to 71207
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

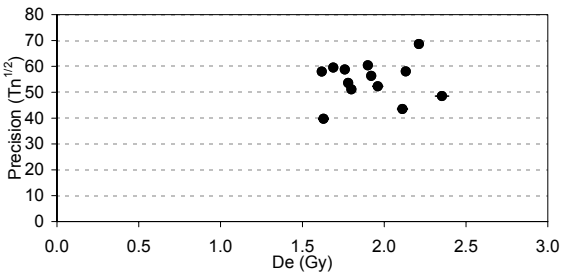
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.02	0.00	3.01	9.04	12.06	15.07	0.00	6.02	6.02

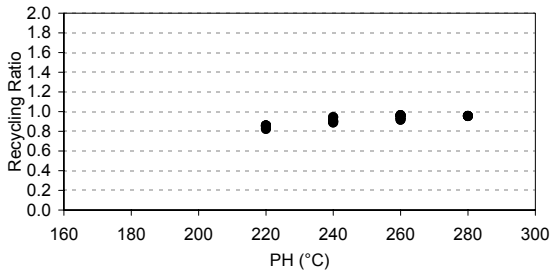
Test Dose (Gy) 0.99

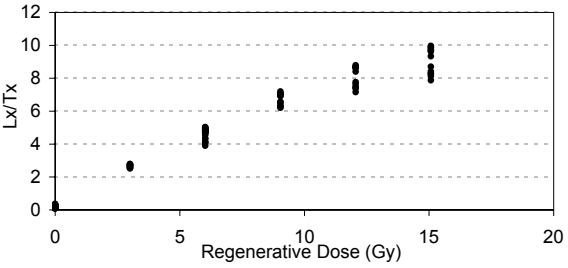
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

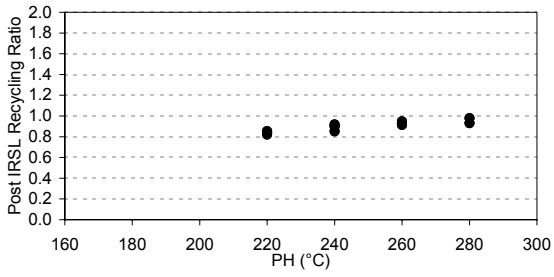
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.02 Gy		Post IRSL 6.02 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	4.7	1008	2.0	15	0.4	0.85	0.02	0.85	0.02	0.065	0.002	2.213	0.020	*Estimate*	*Estimate*	*Parame*
18	220	2.7	876	2.1	14	0.6	0.82	0.03	0.82	0.03	0.077	0.004	2.353	0.040	*Median*	1.90077	
19	220	3.0	1221	2.1	14	0.4	0.86	0.02	0.84	0.02	0.066	0.003	1.901	0.020	*A15 mea*	1.91315	c=1.5: C
20	220	2.8	1137	1.9	15	0.5	0.86	0.02	0.84	0.02	0.062	0.003	1.921	0.020	*H15 mea*	1.90621	c=1.5: C
21	240	4.0	890	2.0	14	0.4	0.89	0.02	0.85	0.02	0.062	0.002	1.690	0.020	*MAD*	0.2112	
22	240	3.4	993	1.9	15	0.5	0.90	0.02	0.90	0.02	0.059	0.002	1.619	0.020	*MADe*	0.31312	
23	240	2.8	981	1.7	21	0.9	0.94	0.03	0.92	0.03	0.043	0.002	1.961	0.030	*sMAD*	0.31312	
24	240	3.5													*H15 Std*	0.24754	c=1.5: C
25	260	3.1	931	1.7	20	0.8	0.96	0.03	0.92	0.02	0.038	0.002	1.780	0.020			
26	260	3.4	997	1.7	20	0.8	0.94	0.02	0.93	0.02	0.049	0.002	2.132	0.020			
27	260	3.4	772	1.7	18	0.7	0.92	0.03	0.91	0.03	0.053	0.003	1.800	0.020			
28	260	3.4	1021	1.6	21	0.8	0.96	0.02	0.95	0.02	0.049	0.002	1.760	0.020			
29	280	2.8															
30	280	3.7															
31	280	2.5	635	2.0	23	1.5	0.96	0.03	0.98	0.04	0.042	0.003	1.629	0.030			
32	280	3.1	614	1.5	20	1.0	0.95	0.03	0.93	0.03	0.043	0.003	2.112	0.030			
													n =	13		n =	13
Mean		3.3	929	1.8	17.6		0.91		0.90		0.055	Mean	1.913	Internal		H15 mean	1.906
SD		0.6	175	0.2	3.1		0.05		0.05		0.012	SD	0.232	Error		H15 Std Dev	0.248
SD/rtN		0.2	49	0.1	0.9		0.01		0.01		0.003	SD/rtN	0.064	0.007		SD/rtN	0.069
%err		5	5	3	5		1		2		6	%err	3			%err	4

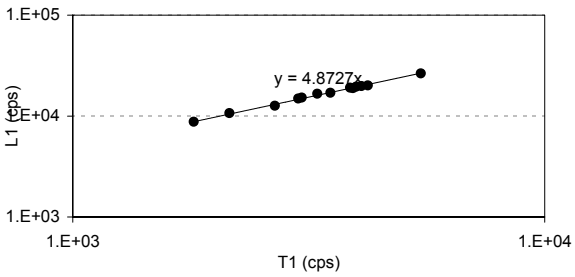


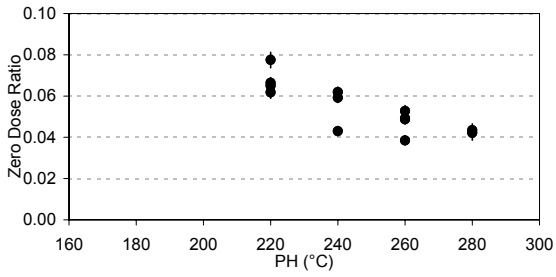


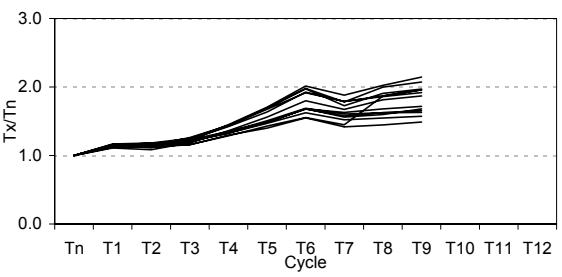












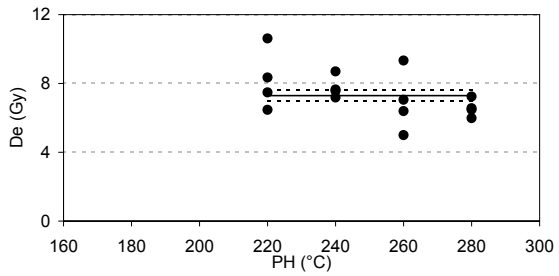
Sample SUTL 2222
Date 31207 to 71207
Reader Riso 1
Source Calibration 0.1006 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

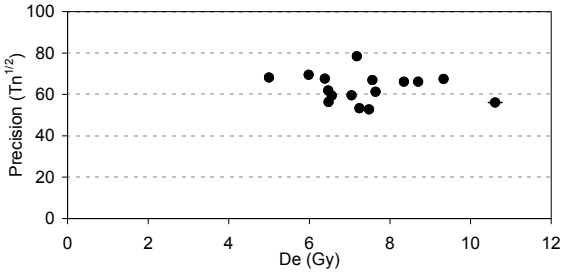
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.02	0.00	3.01	9.04	12.06	15.07	0.00	6.02	6.02

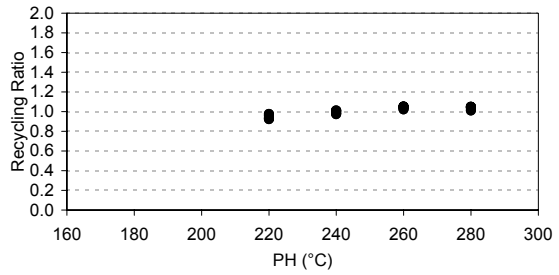
Test Dose (Gy) 0.99

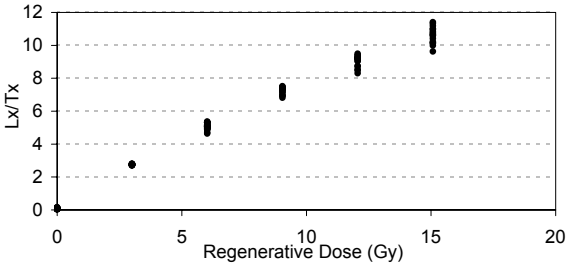
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

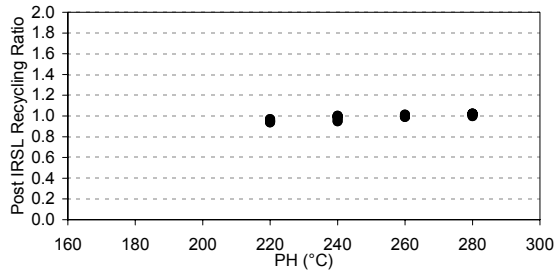
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.02 Gy		Post IRSL 6.02 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	2.4	1317	1.6	18	0.9	0.94	0.03	0.94	0.03	0.034	0.003	10.610	0.171	*Estimate*	*Estimate*	*Parame*
34	220	2.4	1833	1.4	19	0.8	0.98	0.03	0.97	0.03	0.027	0.003	8.347	0.101	*Median*	7.21086	
35	220	2.5	1540	1.4	20	1.0	0.96	0.03	0.95	0.03	0.025	0.003	6.467	0.080	*A15 mea*	7.27212	c=1.5: C
36	220	1.7	1645	1.4	22	1.4	0.92	0.03	0.95	0.03	0.027	0.003	7.482	0.111	*H15 mea*	7.29464	c=1.5: C
37	240	2.2	1998	1.6	24	1.0	0.99	0.02	0.98	0.02	0.023	0.002	8.699	0.091	*MAD*	0.73919	
38	240	2.9	2130	1.4	24	0.9	1.01	0.02	1.00	0.02	0.018	0.001	7.181	0.060	*MADe*	1.09592	
39	240	2.2	1716	1.3	22	1.1	1.00	0.03	1.00	0.03	0.023	0.002	7.643	0.091	*sMAD*	1.09592	
40	240	2.6	1731	1.5	24	1.1	0.97	0.02	0.95	0.02	0.017	0.002	7.563	0.070	*H15 Std*	1.20843	c=1.5: C
41	260	3.0	1525	1.4	30	1.5	1.02	0.02	1.01	0.02	0.013	0.001	9.333	0.091			
42	260	3.1	1507	1.5	23	0.9	1.05	0.02	1.00	0.02	0.019	0.002	4.998	0.050			
43	260	2.9	1586	1.2	22	0.9	1.05	0.03	1.00	0.02	0.018	0.002	6.386	0.060			
44	260	2.1	1699	1.5	21	0.9	1.04	0.03	0.99	0.03	0.020	0.002	7.050	0.080			
45	280	3.3	965	1.3	30	2.0	1.05	0.03	1.02	0.03	0.016	0.002	6.477	0.070			
46	280	4.9	990	1.2	31	1.6	1.05	0.02	1.02	0.02	0.018	0.002	5.984	0.050			
47	280	2.5	1420	1.2	28	1.6	1.04	0.03	1.00	0.03	0.020	0.002	6.557	0.070			
48	280	2.8	1019	1.2	27	1.8	1.01	0.03	1.01	0.03	0.024	0.003	7.241	0.091			
													n =	16		n =	16
Mean		2.7	1539	1.4	24.2		1.00		0.99		0.021	Mean	7.376	Internal		H15 mean	7.295
SD		0.7	339	0.1	4.0		0.04		0.03		0.005	SD	1.370	Error		H15 Std Dev	1.208
SD/rtN		0.2	85	0.0	1.0		0.01		0.01		0.001	SD/rtN	0.342	0.022		SD/rtN	0.302
%err		7	6	2	4		1		1		6	%err	5			%err	4

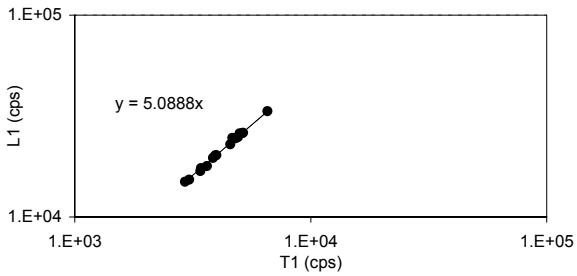


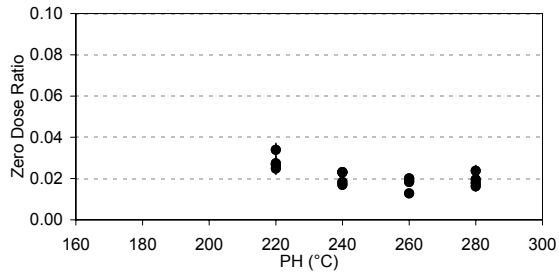


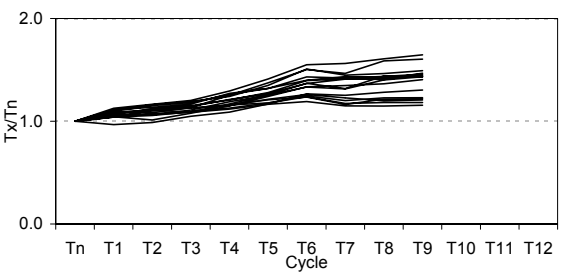












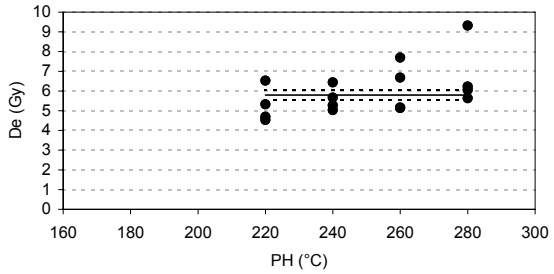
Sample SUTL 2223
Date 31207 to 31207
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

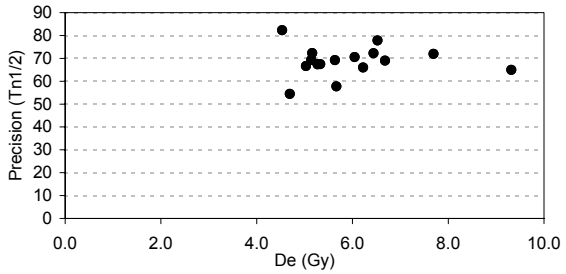
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.43	11.24	14.04	0.02	5.63	5.63

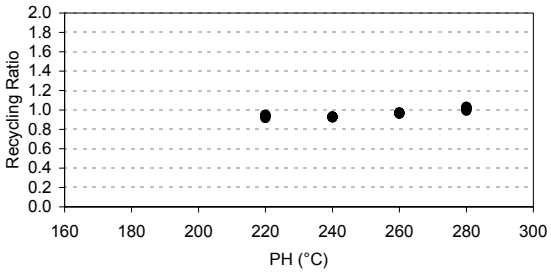
Test Dose (Gy) 0.96

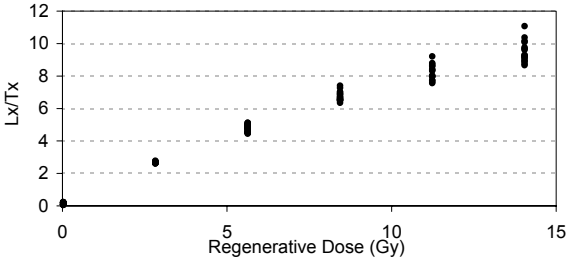
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

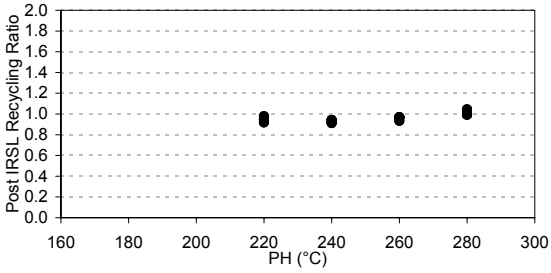
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	2.4	2947	1.7	15	0.6	0.94	0.02	0.94	0.02	0.036	0.003	4.533	0.047	*Estimate*	*Estimate value*
2	220	2.1	3011	1.7	14	0.4	0.95	0.03	0.98	0.03	0.045	0.003	6.524	0.056	*Median*	5.65
3	220	2.9	1640	1.6	11	0.3	0.92	0.03	0.92	0.03	0.048	0.004	5.328	0.056	*A15 mea*	5.77072
4	220	3.2	968	1.6	12	0.3	0.94	0.04	0.95	0.04	0.044	0.005	4.692	0.047	*H15 mea*	5.79514
5	240	2.6	1824	1.9	15	0.4	0.92	0.03	0.92	0.02	0.045	0.003	5.271	0.037	*MAD*	0.59818
6	240	3.6	966	1.7	17	0.4	0.93	0.03	0.94	0.03	0.039	0.004	5.664	0.037	*MADe*	0.88686
7	240	3.3	1404	1.9	15	0.3	0.93	0.03	0.91	0.02	0.047	0.003	5.028	0.037	*sMAD*	0.88686
8	240	2.4	2269	1.8	16	0.5	0.93	0.02	0.94	0.02	0.045	0.003	6.440	0.056	*H15 Std*	0.95098
9	260	3.2	1567	1.8	21	0.6	0.96	0.02	0.97	0.02	0.041	0.002	5.141	0.037		
10	260	2.4	2275	1.8	22	0.7	0.96	0.02	0.93	0.02	0.039	0.002	5.159	0.037		
11	260	3.2	1554	1.9	20	0.6	0.97	0.02	0.97	0.02	0.045	0.002	6.683	0.047		
12	260	2.2	2459	1.8	16	0.4	0.97	0.02	0.96	0.02	0.034	0.002	7.692	0.065		
13	280	3.0	1734	1.7	20	0.5	1.03	0.02	1.00	0.02	0.029	0.002	6.047	0.037		
14	280	2.0	2501	1.7	22	0.8	0.99	0.02	0.99	0.02	0.035	0.002	5.636	0.047		
15	280	2.3	1978	1.7	27	1.0	1.02	0.02	1.04	0.02	0.024	0.002	6.225	0.037		
16	280	2.3	1917	1.7	24	0.9	1.01	0.02	1.00	0.02	0.036	0.002	9.319	0.075		
													n =	16	n =	16
Mean		2.7	1938	1.7	18.0		0.96		0.96		0.039	Mean	5.961	Internal	H15 mean	5.795
SD		0.5	610	0.1	4.4		0.04		0.04		0.007	SD	1.220	Error	H15 Std Dev	0.951
SD/rtN		0.1	153	0.0	1.1		0.01		0.01		0.002	SD/rtN	0.305	0.012	SD/rtN	0.238
%err		5	8	1	6		1		1		4	%err	5		%err	4

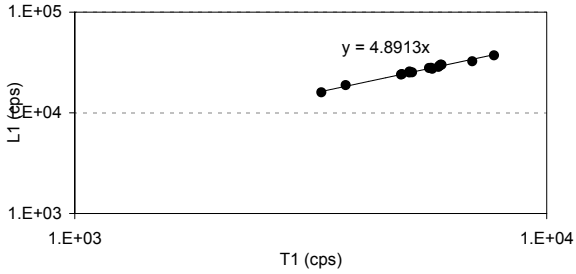


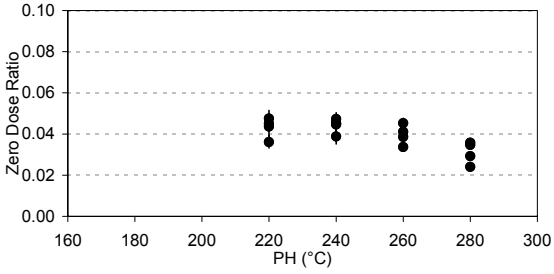


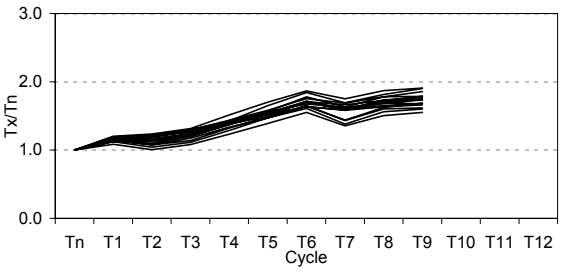












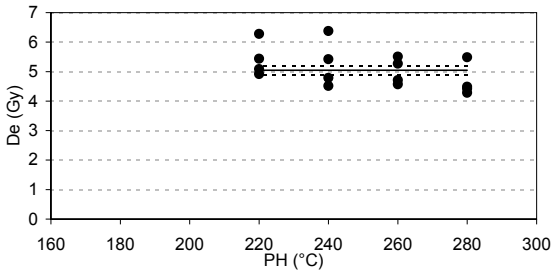
Sample SUTL 2224
Date 31207 to 31207
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

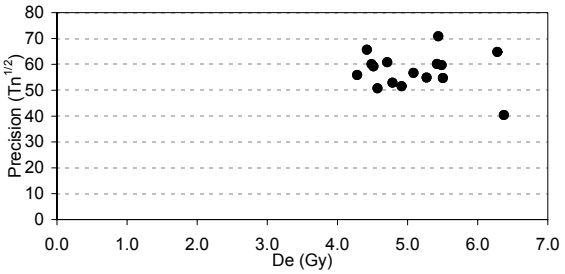
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.43	11.24	14.04	0.02	5.63	5.63

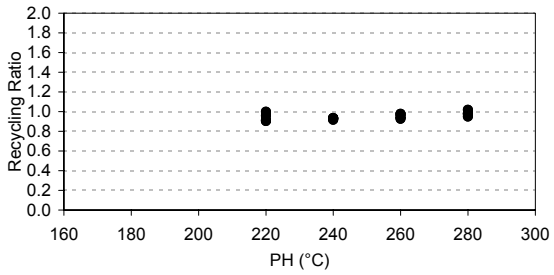
Test Dose (Gy) 0.96

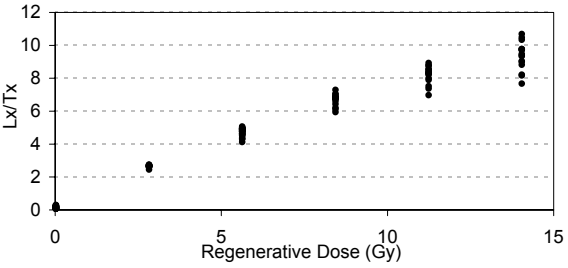
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

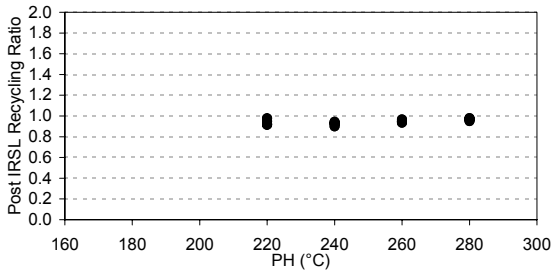
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
17	220	1.9	2762	1.5	14	0.5	0.96	0.03	0.95	0.03	0.043	0.004	5.440	0.056	*Estimate*	*Estimate*	*Parame*
18	220	1.9	1461	1.6	14	0.7	1.00	0.04	0.98	0.04	0.034	0.005	4.916	0.065	*Median*	5.00041	
19	220	1.9	1768	1.6	12	0.4	0.90	0.03	0.92	0.03	0.050	0.005	5.085	0.056	*A15 mea*	5.05951	c=1.5: C
20	220	1.7	2578	1.7	16	0.6	0.91	0.03	0.92	0.03	0.068	0.005	6.281	0.065	*H15 mea*	5.04712	c=1.5: C
21	240	2.9	1264	1.7	18	0.5	0.92	0.03	0.93	0.03	0.039	0.003	4.514	0.028	*MAD*	0.46265	
22	240	3.0	976	2.0	16	0.5	0.93	0.03	0.90	0.03	0.052	0.004	4.785	0.037	*MADe*	0.68593	
23	240	2.9	588	1.8	15	0.4	0.93	0.04	0.94	0.04	0.059	0.006	6.374	0.047	*sMAD*	0.68593	
24	240	1.9	1989	1.6	18	0.6	0.93	0.03	0.92	0.03	0.030	0.003	5.421	0.047	*H15 Std*	0.60767	c=1.5: C
25	260	2.9	1078	1.8	18	0.5	0.97	0.03	0.95	0.03	0.038	0.003	5.505	0.037			
26	260	2.4	1610	1.7	15	0.4	0.94	0.03	0.95	0.03	0.046	0.003	4.711	0.037			
27	260	2.0	1344	1.8	19	0.5	0.93	0.03	0.94	0.03	0.043	0.003	4.570	0.028			
28	260	2.1	1498	1.9	21	0.8	0.98	0.03	0.97	0.03	0.031	0.003	5.271	0.047			
29	280	2.2	2045	1.6	23	0.8	0.98	0.02	0.97	0.02	0.040	0.002	4.421	0.028			
30	280	2.3	1640	1.7	21	0.7	0.98	0.03	0.97	0.03	0.034	0.002	4.486	0.037			
31	280	1.9	1715	1.7	24	1.0	0.95	0.03	0.95	0.03	0.044	0.003	4.281	0.037			
32	280	2.2	1693	1.6	22	0.7	1.02	0.03	0.98	0.03	0.024	0.002	5.486	0.037			
													n =	16		n =	16
Mean		2.3	1626	1.7	17.8		0.95		0.94		0.042	Mean	5.097	Internal		H15 mean	5.047
SD		0.4	553	0.1	3.5		0.03		0.02		0.011	SD	0.632	Error		H15 Std Dev	0.608
SD/rtN		0.1	138	0.0	0.9		0.01		0.01		0.003	SD/rtN	0.158	0.011		SD/rtN	0.152
%err		5	9	2	5		1		1		7	%err	3			%err	3

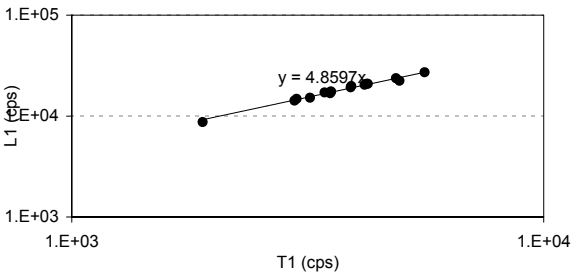


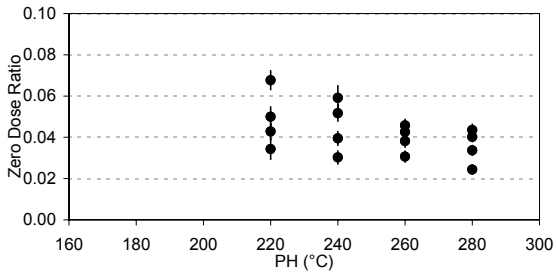


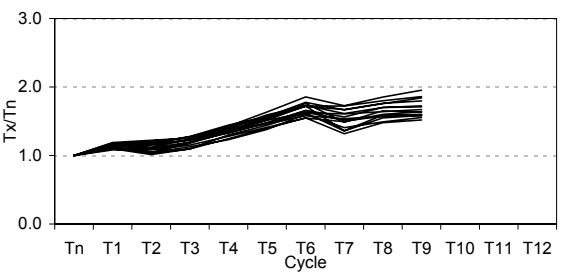












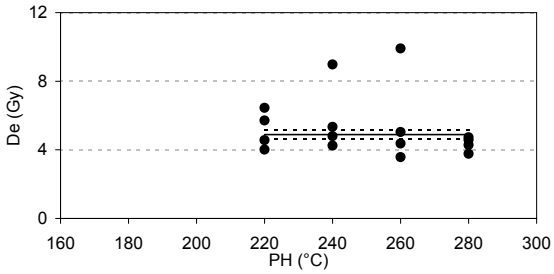
Sample SUTL 2226
Date 31207 to 31207
Reader Riso 2
Source Calibration 0.0935 ± 0.001 Gy/s
Regenerative Dose Sequence (Gy)

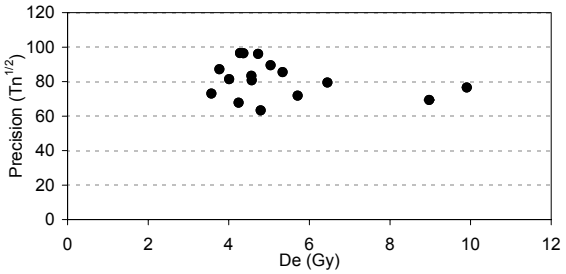
Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	5.63	0.02	2.83	8.43	11.24	14.04	0.02	5.63	5.63

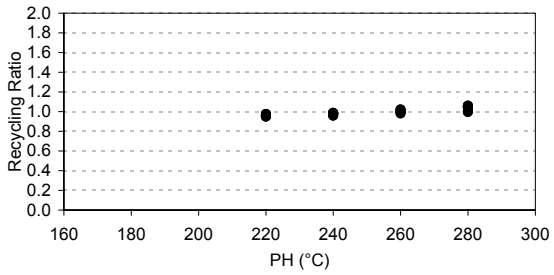
Test Dose (Gy) 0.96

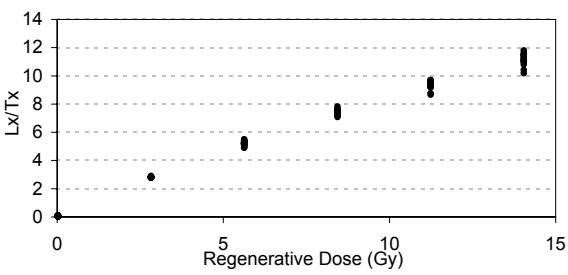
Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

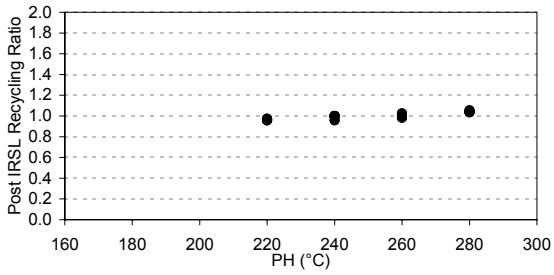
Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 5.63 Gy		Post IRSL 5.63 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0		
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI		
33	220	1.3	4143	1.2	16	0.9	0.95	0.03	0.96	0.03	0.013	0.003	5.711	0.075	*Estimate*	*Estimate*	*Parame*
34	220	2.4	3024	1.3	12	0.3	0.97	0.02	0.97	0.02	0.015	0.003	4.561	0.047	*Median*	4.64991	
35	220	4.1	1690	1.3	14	0.4	0.96	0.03	0.96	0.03	0.022	0.003	4.010	0.037	*A15 mea*	4.77616	c=1.5: C
36	220	2.1	3142	1.3	14	0.6	0.95	0.02	0.96	0.03	0.025	0.003	6.449	0.084	*H15 mea*	4.89098	c=1.5: C
37	240	-1.2	-3486	1.4	17	0.8	0.99	0.03	1.00	0.03	0.014	0.003	4.795	0.065	*MAD*	0.52341	
38	240	2.0	3817	1.4	19	0.7	0.96	0.02	0.96	0.02	0.013	0.002	5.337	0.047	*MADe*	0.776	
39	240	1.6	3000	1.4	8	0.1	0.98	0.03	1.00	0.03	0.018	0.002	4.243	0.047	*sMAD*	0.776	
40	240	1.7	2952	1.4	20	1.1	0.98	0.03	1.00	0.03	0.011	0.002	8.973	0.122	*H15 Std*	1.05774	c=1.5: C
41	260	2.2	2536	1.4	21	0.9	0.98	0.02	1.00	0.02	0.015	0.002	3.570	0.037			
42	260	1.7	5711	1.4	19	0.8	1.00	0.02	1.01	0.02	0.018	0.001	4.365	0.047			
43	260	2.7	3095	1.4	20	0.5	1.00	0.02	0.98	0.02	0.014	0.001	5.038	0.037			
44	260	1.7	3603	1.4	21	1.0	1.02	0.02	1.03	0.02	0.014	0.002	9.907	0.112			
45	280	1.4	6957	1.3	24	1.1	1.06	0.02	1.04	0.02	0.009	0.001	4.281	0.037			
46	280	2.1	3783	1.4	20	0.8	1.04	0.02	1.04	0.02	0.012	0.001	3.767	0.037			
47	280	-0.3	-32143	1.5	26	1.2	1.05	0.02	1.05	0.02	0.009	0.001	4.729	0.047			
48	280	1.7	4009	1.5	23	1.0	1.00	0.02	1.04	0.02	0.011	0.001	4.570	0.047			
													n =	16		n =	16
Mean		1.7	990	1.4	18.4		0.99		1.00		0.015	Mean	5.269	Internal		H15 mean	4.891
SD		1.2	9097	0.1	4.7		0.03		0.03		0.004	SD	1.788	Error		H15 Std Dev	1.058
SD/rtN		0.3	2274	0.0	1.2		0.01		0.01		0.001	SD/rtN	0.447	0.016		SD/rtN	0.264
%err		17	230	1	6		1		1		8	%err	8			%err	5

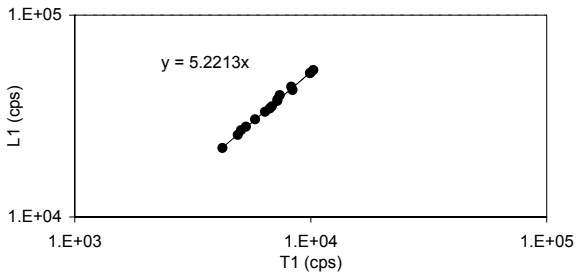


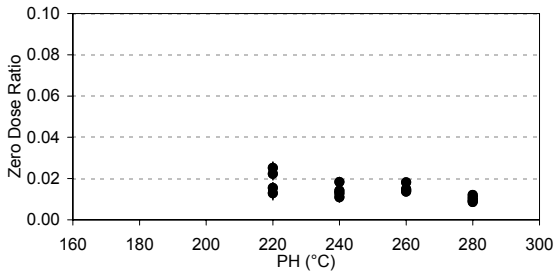


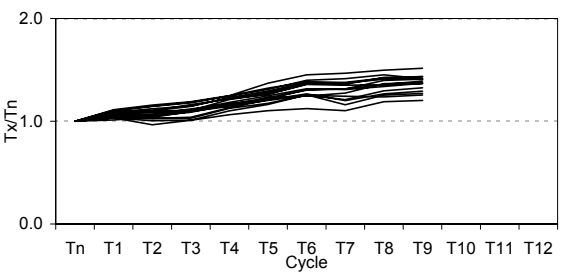












Sample SUTL 2227
Date 71207 to 81207
Reader Riso 1
Source Calibration 0.1005 ± 0.0017 Gy/s
Regenerative Dose Sequence (Gy)

Dn	D1	D2	D3	D4	D5	D6	D7	D8	D9
0.00	6.02	0.00	3.01	9.04	12.05	15.07	0.00	6.02	6.02

Test Dose (Gy) 0.99

Measurement	Signal	Background
OSL 60s@125°C, 240Cl	11-30	191-230
IRSL 120s@50°C, 240Cl	11-30	191-230

Aliquot	Preheat	Aliquot Mass	Sensitivity (cps/	Change	Dose Response		Recycling Point 6.02 Gy		Post IRSL 6.02 Gy		Zero Dose 0.00 Gy		Equivalent Dose		AMC Robust Statistics V1.0	
	(°C/30s)	(g)	mg/Gy)	(frn.)	D0 (Gy)	Err	ratio	error	ratio	error	ratio	error	(Gy)	error	ROBUST STATISTICS SUI	
1	220	3.8	889	1.7	18	0.8	0.95	0.03	0.96	0.03	0.031	0.003	4.635	0.060	*Estimate*	*Estimate value*
2	220	4.5	743	1.8	17	0.8	0.92	0.03	0.90	0.03	0.043	0.003	6.505	0.090	*Median*	6.34932
3	220	2.4	1026	1.5	21	1.2	0.96	0.03	0.96	0.03	0.023	0.003	8.798	0.141	*A15 mea*	5.81861
4	220	3.4	852	1.5	22	1.3	0.93	0.03	0.93	0.03	0.034	0.003	4.374	0.060	*H15 mea*	5.81861
5	240	3.2	1312	1.4	23	1.1	1.05	0.03	1.07	0.03	0.054	0.003	7.571	0.080	*MAD*	0.85462
6	240	3.8	870	1.8	21	0.9	0.99	0.03	0.99	0.03	0.039	0.003	4.907	0.060	*MADe*	1.26706
7	240	4.7	1017	1.8	21	0.8	0.97	0.02	0.99	0.02	0.045	0.002	5.902	0.060	*sMAD*	1.26706
8	240	2.8	1407	1.7	21	0.8	0.98	0.02	0.96	0.02	0.035	0.002	6.837	0.070	*H15 Std*	1.43037
9	260	2.9	1191	1.6	40	3.2	1.08	0.03	1.08	0.03	0.036	0.002	6.555	0.070		
10	260	3.3	973	1.5	33	2.5	1.12	0.03	1.11	0.03	0.056	0.003	6.354	0.080		
11	260	3.5	982	1.5	28	1.7	1.06	0.03	1.04	0.03	0.043	0.003	6.344	0.070		
12	260	3.2	1491	1.7	28	1.3	1.04	0.02	1.04	0.02	0.036	0.002	6.385	0.060		
13	280	2.8	1255	1.3	92	18.4	1.16	0.03	1.17	0.03	0.042	0.003	4.233	0.050		
14	280	1.9	806	1.3	87	26.3	1.22	0.05	1.21	0.05	0.059	0.006	6.455	0.111		
15	280	2.7	948	1.3	45	5.5	1.15	0.04	1.20	0.04	0.057	0.004	3.549	0.050		
16	280	2.8	860	1.2	58	10.0	1.23	0.05	1.25	0.05	0.059	0.005	4.404	0.070		
													n =	16		n = 16
Mean		3.2	1039	1.5	35.9		1.05		1.05		0.043	Mean	5.863	Internal		H15 mean 5.819
SD		0.7	225	0.2	23.7		0.10		0.11		0.011	SD	1.396	Error		H15 Std Dev 1.430
SD/rtN		0.2	56	0.0	5.9		0.03		0.03		0.003	SD/rtN	0.349	0.019		SD/rtN 0.358
%err		6	5	3	17		2		3		6	%err	6			%err 6